

Horizon Seafari Versatile Model 450 - 1800

Owner's Manual

Release Date: February 2014



Seafari Versatile Self Contained

Single Membrane (-1)

HRO Seafari SFC-450-1

HRO Seafari SFC-700-1

HRO Seafari SFC-900-1

Double Membrane (-2)

HRO Seafari SFC-900-2

HRO Seafari SFC-1400-2

HRO Seafari SFC-1800-2

Seafari Versatile Modular

Single Membrane (-1)

HRO Seafari SFM-450-1

HRO Seafari SFM-700-1

HRO Seafari SFM-900-1

Double Membrane (-2)

HRO Seafari SFM-900-2

HRO Seafari SFM-1400-2

HRO Seafari SFM-1800-2

PREFACE

Thank you for purchasing an Horizon Reverse Osmosis Desalination System. Please read this manual carefully before attempting installation or operation. A better understanding of the system ensures optimum performance and longer service life from the system.

All Horizon Reverse Osmosis desalination systems are designed and engineered to function as a complete working unit. Generally speaking, the performance of each component within the unit is dependent on the component prior to it and governs the performance of all components after it. Proper performance of the system is thus dependent upon proper operation of every single component within the system.

The intent of this manual is to allow the operator to become familiar with each component within the Horizon Seafari system. By understanding the function, importance, and normal operation of each component within each subsystem of the unit, the operator can readily diagnose minor problems. Such problems, when they first develop, usually require minor maintenance and are easily corrected. However, left unattended, a problem in one component affects the rest of the system and leads to further required repairs.

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SYSTEM IDENTIFICATION INFORMATION

INSTRUCTIONS: Please complete the following information at the time of purchase of the Horizon Seafari R.O. Desalinator. This Information will be requested to provide a more efficient service when contacting HRO System's Service Department, Technical Assistance, or the Purchasing Parts Department.

SYSTEM INFORMATION:

Model Number: _____ **Serial Number:** _____

Operating Voltage:

Alternating Current Single Phase:

___ 120 VAC, 60 Hz ___ 230 VAC, 60 Hz ___ 220 VAC, 50 Hz

Alternating Current Three Phase:

___ 208/230 VAC, 60 Hz ___ 460 VAC, 60 Hz
___ 220 VAC, 50 Hz ___ 380 VAC, 50 Hz

Date Purchased: _____ **Date Commissioned:** _____
(first tested/operated)

DEALER INFORMATION:

Business Name: _____

Address: _____

City: _____ **State:** _____ **Postal Code:** _____

Country: _____

Dealer's Invoice Number: _____

KEEP THIS COPY IN THE OWNER'S MANUAL



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www.hrosystems.com



WARRANTY REGISTRATION INFORMATION

INSTRUCTIONS: At the time of purchase of a HRO Systems R.O. Desalinator, please complete the warranty information listed below and mail it to HRO Systems, Attn: Warranty Registration.

SYSTEM INFORMATION:

Model Number: _____ **Serial Number:** _____

Date Purchased: _____ **Date Commissioned:** _____
(first tested/operated)

CUSTOMER INFORMATION:

Customer Name: _____

Address: _____

City: _____ **State:** _____ **Postal Code:** _____

Country: _____

DEALER INFORMATION:

Business Name: _____

Address: _____

City: _____ **State:** _____ **Postal Code:** _____

Country: _____

Dealer's Invoice Number: _____

MAIL THIS COPY TO:

Horizon Reverse Osmosis (HRO Systems)
Attn: Warranty Registration
PO Box 5463
Carson, CA 90745 - 5463 USA

Or download and complete the fillable form at our website: www.hrosystems.com, and email it to:
sales@hrosystems.com

REVISION HISTORY

Rev.	Date	Affected Pages	Description
Ø	April 15, 2008	Appendix A p A-3 to A-6	Wiring Diagram: Δ Replace all drawing with new drawings. Reported 4/9/08
1	May 20, 2008	TOC, p v	Table of Content: Add "Section L"
2	May 20, 2008	Section D, p 6-7	Graphic: Replace touch pad illustration with new graphic. Reported 5/14/08
3	May 20, 2008	Section I , p 10	Graphic: Replace touch pad illustration with new graphic. Reported 5/14/08
4	Sept 11, 2008	Section E p 17 & 19	Add reference to UV installation details p 17. Add UV installation details p 19-21. Reported 9/11/08
5	Sept 11, 2008	Section K p 12 - 13	Add reference to UV maintenance details p 12. Add UV maintenance details p 13-18. Reported 9/11/08
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11	June 4, 2012	Section 10	Added HP75 Drawings and Removed N200 Drawings
12	October 3, 2013	Section 6-3	Fig 6c -P&ID was updated
13	Feb. 15, 2014	Entire Manual	Revised and reorganized all topics within manual

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INTRODUCTION

Seafari Versatile 450 - 1800

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LIMITED WARRANTY

HRO Systems warrants that the Horizon Seafari Desalination System performs according to the specifications for a period of twelve (12) months and specifically listed components are warranted for up to 5 years from the date of shipment. HRO Systems, under no circumstances, is liable for damages arising out of or in any way connected with the failure of the system to perform as set forth herein. This limited warranty is in lieu of all other expressed or implied warranties, including those of merchantability and fitness for a particular purpose.

The warranty period is from the date of original shipment from HRO Systems factory.

The following items are covered under warranty for the periods designated:

System and Accessories	1 (one) year
High Pressure Vessel	5 (five) years
HP Pump (manifold)	5 (five) years
Repairs after warranty	3 (three) months

The following items are considered normal user maintenance and are not covered under warranty:

- | | |
|------------------------------|---------------------------------|
| 1. Sea Strainer Element | 7. Pump Crankcase Oil |
| 2. Cartridge Filter Elements | 8. Gauge Instrument Calibration |
| 3. Sand & Gravel in the MMF | 9. Fuses |
| 4. Pump Packing Assemblies | 10. Valve Seals and Packings |
| 5. Pump Seal Assemblies | 11. Exterior Corrosion |
| 6. Pump Valve Assemblies | |

Installation of components not supplied by HRO Systems, are not covered by this or any limited warranty.

Improper installation, resulting in system failure or component failure or decline in performance is not covered by this or any limited warranty.

The Reverse Osmosis Membrane Element is warranted for a period of one year from the date of shipment of the membrane. Any misuse or improper operation or maintenance of the system that causes premature fouling of the Membrane Element is not warranted. The Reverse Osmosis Membrane Element is also guaranteed to be cleanable for a minimum of one year from the date of shipment, providing cleaning periods are adhered to and foulant is acid soluble metal hydroxides and calcium carbonates or alkaline soluble organic, inorganic substances and microbiological slimes. The Membrane Element is not warranted for iron fouling (rust), chemical or petroleum products attack, extreme temperatures (over 120 F / under 32 F), drying out or extreme pressures (over 1000 psi).

In the event of a defect, malfunction or failure, specifically covered by this warranty and during the warranty period, HRO Systems will repair or replace, at its option, the product or component therein, which upon examination by HRO Systems appears to be defective.

To obtain warranty service, the defective product or part must be returned to an authorized HRO Systems Factory Service Center (dealer) or direct to HRO Systems. The end user must pay any transportation and labor expenses incurred in removing and returning the product to the service center or HRO Systems pending evaluation and warranty approval. Upon warranty approval, reasonable expenses will be reimbursed.

The limited warranty does not extend to any system or system component which has been subjected to alteration, misuse, neglect, accident, improper installation, inadequate or improper repair or maintenance or subject to use in violation of instructions furnished by HRO Systems, nor does the warranty extend to components on which the serial number has been removed, defaced or changed.

HRO Systems reserves the right to make changes or improvements in its product, during subsequent production, without incurring the obligation to install such changes or improvements on previously manufactured equipment.

The implied warranties, which the law imposes on the sale of this product, are expressly LIMITED in duration to the time period above. HRO Systems shall not be liable for damages, consequential or otherwise, resulting from the use and operation of this product, or from the breach of this LIMITED WARRANTY.



CAUTION: Use of non HRO Systems supplied parts and accessories, including but not limited to maintenance parts, prefilter elements, cleaning and storage chemical, pump oil, spare parts, replacement parts, system components, installation components and/or system accessories, shall void all warranty expressed or implied.

1 INTRODUCTION

1.1 PURPOSE

This manual is intended for HRO System's system technicians, technical support, and training personnel. This manual contains technical information and instructions for the installation, operation, maintenance, and troubleshooting of the HRO System's Desalination Product.

1.2 SAFETY IN GENERAL

Anyone responsible for the installation, operation, and maintenance of the HRO Desalination System must read this manual thoroughly and comply with the instructions, guidelines, and safety requirements at all times.

1.3 USING THIS MANUAL

Reading this manual in its entirety will help users to become familiar with each component within the system. By understanding the function, importance, and normal operation of each component, users can readily operate and diagnose problems.

Aside from this section, this manual is divided into majors sections.

- Section 2: System Specifications
- Section 3:
- Section 4: System Schematic and Component Descriptions
- Section 5: System Installation
- Section 6: Commissioning
- Section 7: Start-up Procedure
- Section 8: Shutdown Procedure
- Section 9: Troubleshooting Guide
- Section 10: Storage and Cleaning
- Section 11: Maintenance & Repair
- Section 12: Exploded Parts View
- Section 13: Electrical Diagrams
- Section 14: Conversion Charts

Each section should be reviewed in the order provided before performing any system operations.

1.4 TERM USED

The term System refers to the Seafari System in general and will be used throughout this manual.

1.5 SAFETY NOTES

Safety issues that require users attention are highlight through out this manual as follows.

CAUTION: A Caution note provides important information users must know to prevent the possibility of damaging the device or equipment and to prevent the possibility of injuries and/or death.

NOTE: A Note provides additional information users should know to properly and safely operate the equipment.

1.6 GRAPHICS

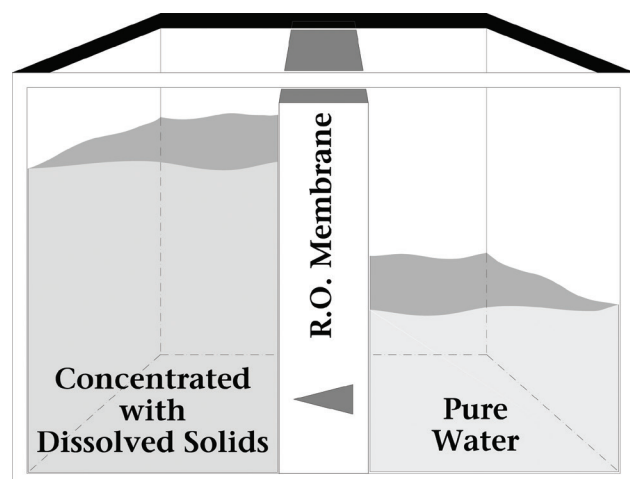
Graphics used are for reference and illustration purposes only, and may not represent the actual part or arrangement of parts in a customized system.

1.7 THE REVERSE OSMOSIS PROCESS

The Obstacle: Osmosis is the naturally occurring diffusion of two miscible (mixable) solutions through a semipermeable membrane in such a manner as to equalize their concentration by allowing a lessor concentration, potable water, to naturally diffuse through a semipermeable membrane into a higher concentration, sea or brackish water.

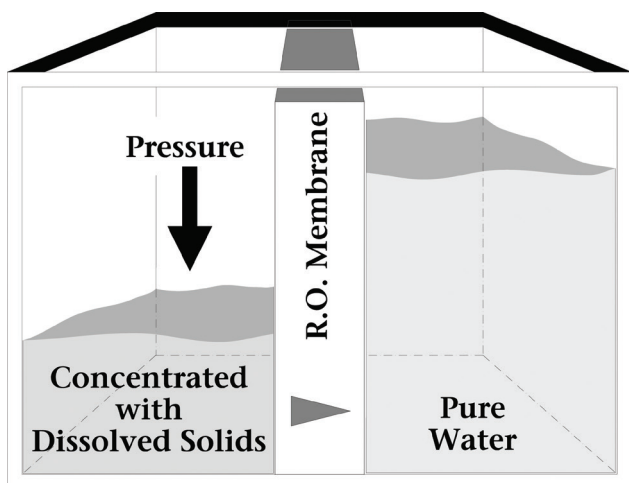
Sea / brackish water is a high concentration solution. Potable water is a low concentration solution.

Therefore, sea water or brackish water cannot naturally diffuse through a semipermeable membrane to provide potable, or drinking water.



The HRO Solution

A manmade process, Reverse Osmosis, overcomes this natural phenomenon. By forcing sea or brackish water (under high pressure) through a semipermeable membrane, potable water can be realized. Reverse Osmosis Desalination Systems by HROSystems make possible the once impossible, potable water from undrinkable water sources.



Low Pressure: Feed Water (Salt Water or Brackish Water) enters the system through an Inlet Valve and is then filtered by a raw water Sea Strainer. The pressure of the Feed water is increased by the Booster Pump and filtered several more times through standard and optional prefiltration units including Media Filter, Plankton Filter, Prefilter and Oil Water Separator.

High Pressure: The Stainless Steel High Pressure Pump then increases the filtered feed water to a high pressure level and forces it into the Reinforced Fiberglass Membrane Vessel Assembly. The Back Pressure Regulator controls and automatically maintains the necessary high pressure level in the membrane. Concentrated brine enters the Brine Water Flow Meter which allows observation of the condition of the High Pressure Pump. The Brine Water is then discharged

through the Brine Discharge Connector and diverted back to the feed source.

Product Water: The product water flows out of the R.O. Membrane and passes into a Salinity Probe which adjusts automatically for temperature changes and registers, electronically, the salt content of the product water. Next, the Product Flow Meter registers the amount of potable water being produced. The product water then proceeds into the 3-Way Solenoid Diversion Valve. Here, potable water is diverted to the Charcoal Filter where gasses or odors present are absorbed and removed from the product water. The final filtration process occurs in the Ultraviolet Sterilizer where 99.9% of all microorganisms, including viruses and bacteria, are destroyed.

Rinsing and Cleaning: The 3-way valves are provided for System Rinsing and Cleaning. The Automatic Fresh Water Flush System maintains fresh water within the System during shut down periods.

Electronics: All electrical connections terminate at the Salinity Controller. Highly advanced, the Salinity Controller features computer controlled reliable solid state electronics with advanced proprietary logic features found in no other desalination system. Various Remote Control units are available for remote operation of the System.

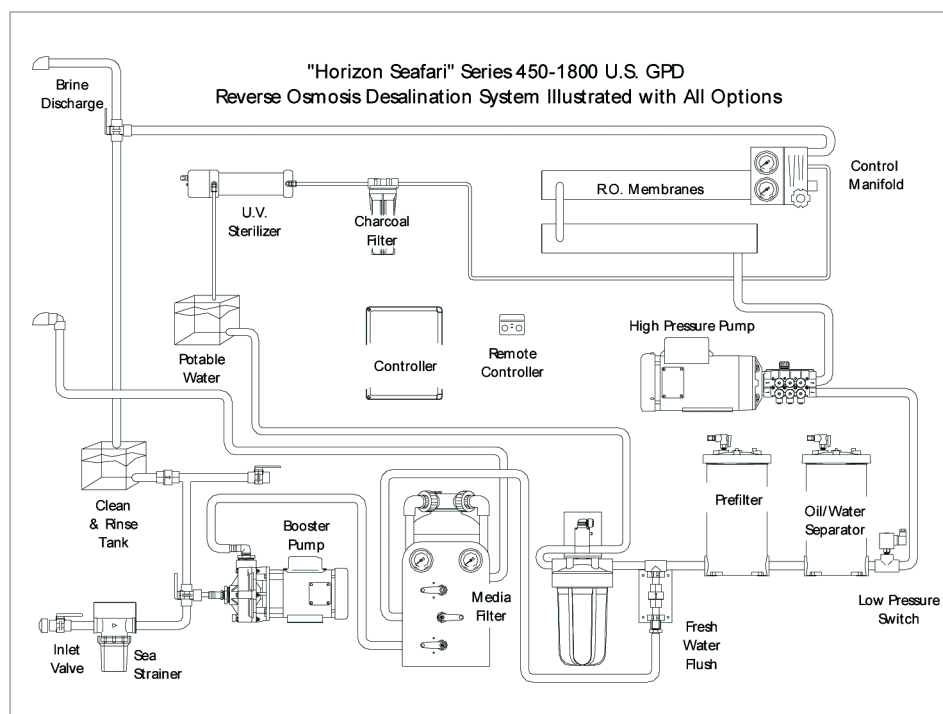
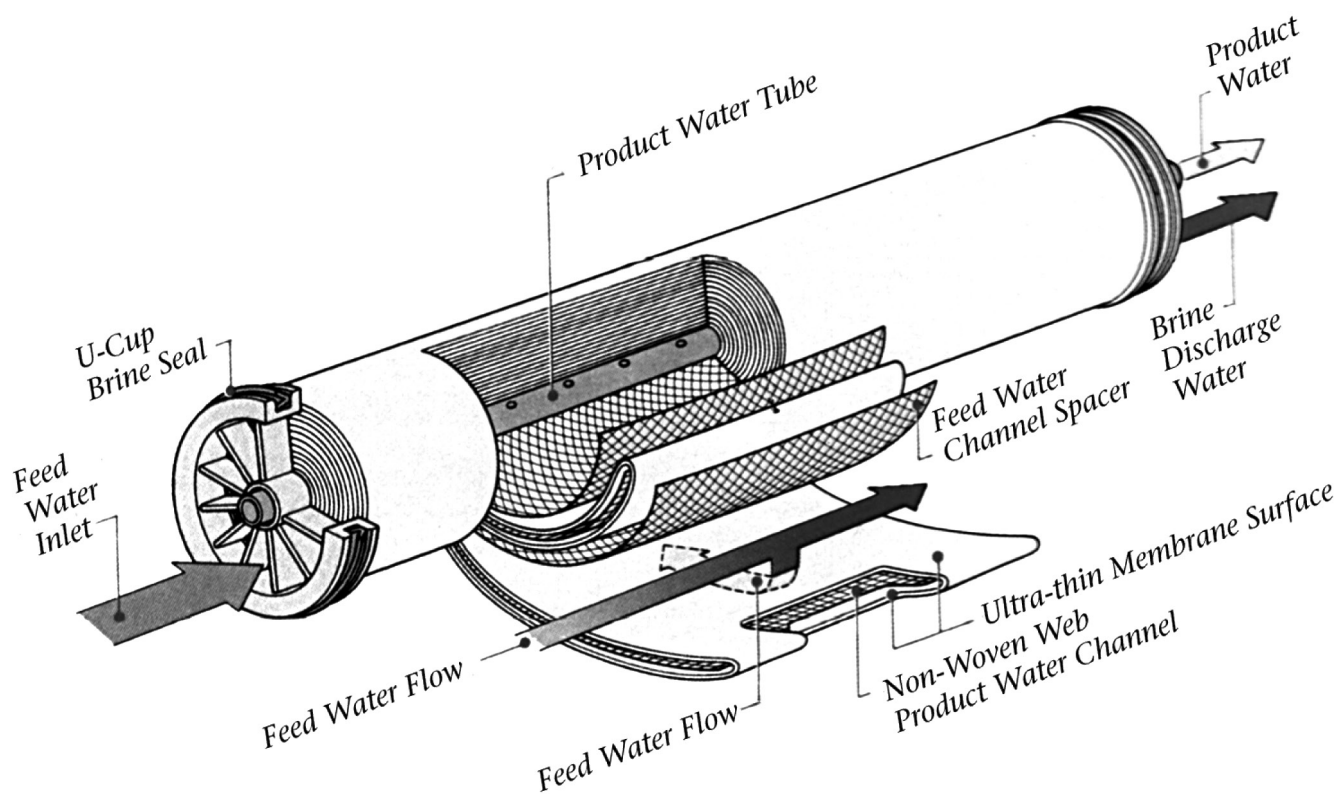
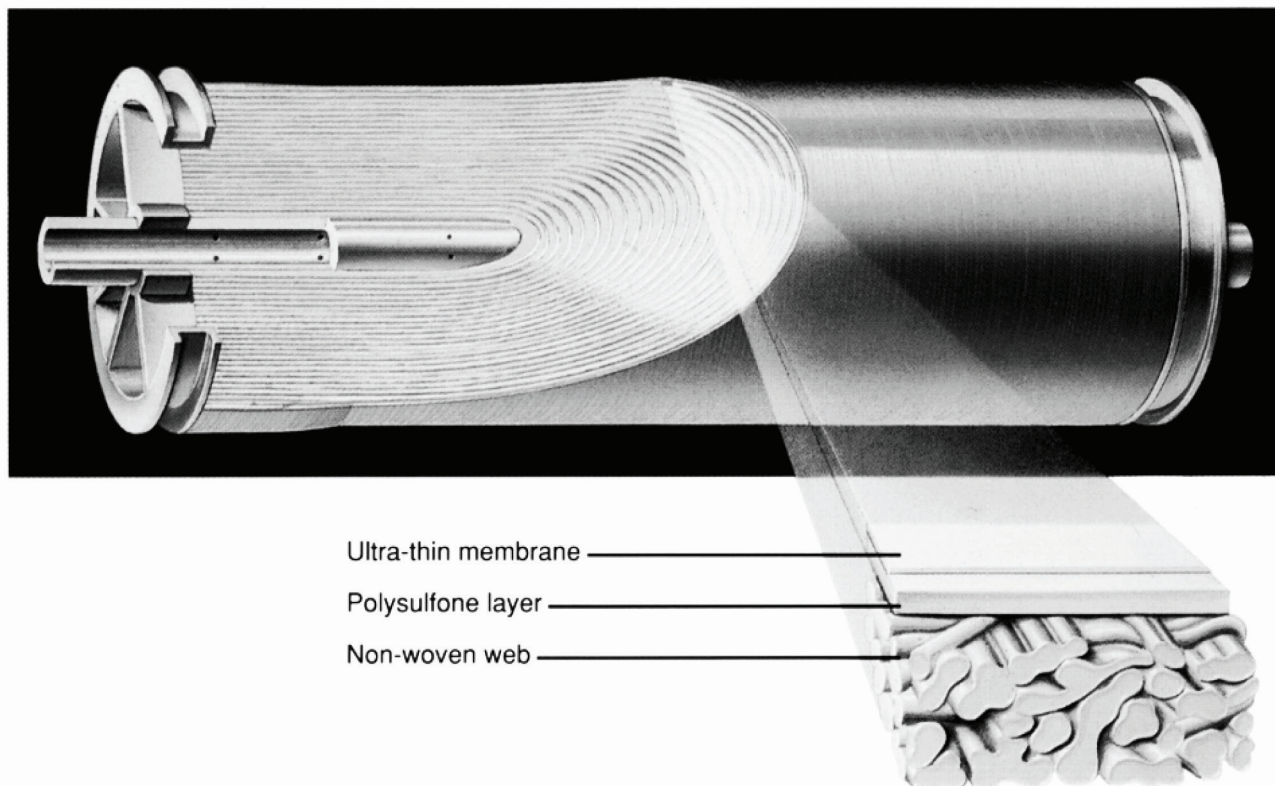


ILLUSTRATION: THE ANATOMY OF A REVERSE OSMOSIS MEMBRANE ELEMENT



1.8 GLOSSARY

Following terms are helpful in becoming familiar with the HRO System.

BOUNDARY LAYER / CONCENTRATION POLARIZATION

When water permeates through the membrane, nearly all the salt is left behind in the brine channel. In any dynamic hydraulic system, the fluid adjacent to the wall of the vessel is moving relatively slow. Even though the main body of the stream is turbulent, a thin film adjacent to the wall (membrane) is laminar. This thin film is called the boundary layer.

At the boundary layer the salts are saturated and can readily adhere to and pack into the R.O. membrane element surface if the Feed Water Flow is insufficient. For this reason it is important to maintain sufficient Feed Water flow, to prevent Concentration Polarization, through the R.O. membrane element.

BRINE VELOCITY

The brine flow over the membrane surface is very important to both product water quality and quantity. At low flows, concentration polarization occurs, causing the water quality to decline.

In addition to inferior product water quality, low brine flows can increase the precipitation of sparingly soluble salts which will foul the R.O. membrane element surface (concentration polarization). If this occurs, the product water flux (production) will decline.

The Feed Pump integrated design provide a relatively smooth and continual flow of Feed Water across and through the R.O. membrane element.

COMPACTION

Some densification of the membrane structure may take place while operating at elevated pressures, above 1000 PSI. The change is known as compaction and is accompanied by a reduction in the water permeation rate.

When the Reverse Osmosis membrane element is subjected to elevated pressures beyond 1000 PSI the Product Water Channel becomes squeezed which results in restriction and in turn product water recovery reduction.

OSMOTIC PRESSURE

The transfer of the water from one side of the membrane to the other will continue until the head (pressure) is great enough to prevent any net transfer of the solvent (water) to the more concentrated (feed water) solution.

At equilibrium, the quantity of water passing in either direction is equal, and the head pressure is then defined as the "Osmotic Pressure" of the solution having that particular concentration of dissolved solids.

PRESSURE

The operating pressure has a direct affect on product water quality and quantity. Both factors will increase as the system pressure increases (higher quantity and higher quality within design limits).

The system must be operated at the lowest pressure required to achieve the designed product water flow rate. This parameter also minimizes compaction, which proceeds at a faster rate at higher pressures as well as at higher temperatures.

The System self adjusts its operating pressure to maintain a precise amount of Product Water Flow. However in so doing, at low temperatures and or high salinity feed water conditions the system will operate at higher than normal pressure in maintaining the specified amount of product water flow. This is normal, to be expected, and is due to the design characteristics of the system.

SPIRAL-WOUND MEMBRANE

The spiral-wound membrane consists of multiple membrane envelopes each formed by enclosing a channelized product water carrying material between two large flat membrane sheets. The membrane envelope is sealed on three edges with a special adhesive and attached with the adhesive to a small diameter pipe.

A polypropylene screen is used to form the feed water channel between the membrane envelopes. A wrap is applied to the membrane element to maintain the cylindrical configuration. The center tube is also the permeate (product water) collecting channel. Several elements may be connected in series within a single or multiple pressure vessels).

WATER TEMPERATURE EFFECT

The product water flow through the membrane is significantly affected by the water temperature.

1

At any given pressure this flow increases with increasing water temperature and is reduced at lower temperatures. The system over comes this factor by self adjusting the operating pressure to maintain a precise amount of Product Water Flow.

2

SYSTEM SPECIFICATIONS

Seafari Versatile 450 - 1800

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2 SYSTEM SPECIFICATIONS

2.1 MODELS

The Seafari Versatile Self Contained and Modular series are available in six models.

Self Contained - Single Membrane (-1)

- HRO Seafari SFC-450-1
- HRO Seafari SFC-700-1
- HRO Seafari SFC-900-1

Self Contained - Double Membrane (-2)

- HRO Seafari SFC-900-2
- HRO Seafari SFC-1400-2
- HRO Seafari SFC-1800-2

Modular - Single Membrane (-1)

- HRO Seafari SFM-450-1
- HRO Seafari SFM-700-1
- HRO Seafari SFM-900-1

Modular - Double Membrane (-2)

- HRO Seafari SFM-900-2
- HRO Seafari SFM-1400-2
- HRO Seafari SFM-1800-2

2.2 PERFORMANCE

PRODUCT WATER PRODUCED PER HOUR AND PER DAY OF OPERATION:

(+/-15% at 850 psig / 56 BAR, 77°F / 25°C & 35,000 PPM TDS Feed Water Salinity)

Model Number	Per 1 hour of operation:		Per 24 hours of operation:	
	Gallons	Liters	Gallons	Liters
HRO Seafari (SF) 450-1	19	71	450	1,703
HRO Seafari (SF) 900-2	38	142	900	3,407
HRO Seafari (SF) 700-1	29	110	700	2,650
HRO Seafari (SF) 1400-2	58	211	1400	5,300
HRO Seafari (SF) 900-1	38	142	900	3,407
HRO Seafari (SF) 1800-2	75	284	1800	6,814

SALT REJECTION (CHLORIDE ION): 99.4%

PRODUCT WATER TEMPERATURE: Ambient to feed water temperature

2.3 SPECIFICATIONS

SALINITY MONITORING: Automatic computer controlled electronic monitoring. Temperature compensated with the Water Quality Indicator. The salinity monitoring components of the system give a continuous readout in micromhos per cubic centimeter, are temperature compensated and of a fail-safe design.

SALINITY RANGE OF FEED WATER:

Seawater up to 50,000 PPM TDS (NaCl) (typical seawater salinity is 35,000 PPM)

TEMPERATURE RANGE: Max. 122°F / 50°C, Min. 33°F / .5°C

SYSTEM FEED WATER:

Model Number	Power Source Cycles	Feed Water Flow / Minute
HRO SFC 450-1 & 900-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFM 450-1 & 900-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFC 700-1 & 1400-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFM 700-1 & 1400-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFC 900-1 & 1800-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFM 900-1 & 1800-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFC 450-1 & 900-2	60Hz	3.0 U.S. Gallons / 11.4 liters
HRO SFM 450-1 & 900-2	60Hz	3.0 U.S. Gallons / 11.4 liters
HRO SFC 700-1 & 1400-2	60Hz	4.2 U.S. Gallons / 15.9 liters
HRO SFM 700-1 & 1400-2	60Hz	4.2 U.S. Gallons / 15.9 liters
HRO SFC 900-1 & 1800-2	60Hz	4.2 U.S. Gallons / 15.9 liters
HRO SFM 900-1 & 1800-2	60Hz	4.2 U.S. Gallons / 15.9 liters

REVERSE OSMOSIS MEMBRANE:

TYPE: Specifically selected High Rejection / High Yield aromatic tri-polyamide, thin film composite, spiral wound, single pass reverse osmosis membrane element.

CHLORINE TOLERANCE: 0.1 PPM.

pH RANGE: 3-11 (typical seawater pH is 8)

SYSTEM PRESSURE:

FEED WATER: Minimum 6 psi / .42 Kg/cm ² / 41.4 kPa	Maximum 40 psi / 2.8 Kg/cm ² / 275.8 kPa
OPERATION: Seawater @ 35,000 PPM & 77° F / 25° C:	Nominal 800 psi / / 56.25 Kg/cm ² / 5516 kPa

EXTERNAL INSTALLATION WATER CONNECTIONS:

Pipe sizes to be supplied by the installer for connection of the HRO Systems supplied components

Feed Inlet:	3/4 MNPT - Male National Pipe Thread U.S. Standard
Brine Discharge	1/2 MNPT - Male National Pipe Thread U.S. Standard
Product	3/8 FNPT - Female National Pipe Thread U.S. Standard

2.4 DIMENSIONS AND WEIGHT

MODEL	Weight	Model No.	Weight
HRO SFC 450-1	147 lbs / 67 kg	HRO SFM 450-1	113 lbs / 51 kg
HRO SFC 900-2	159 lbs / 72 kg	HRO SFM 900-2	125 lbs / 57 kg
HRO SFC 700-1	150 lbs / 68 kg	HRO SFM 700-1	116 lbs / 53 kg
HRO SFC 1400-2	165 lbs / 75 kg	HRO SFM 1400-2	131 lbs / 59 kg
HRO SFC 900-1	152 lbs / 69 kg	HRO SFM 900-1	118 lbs / 54 kg
HRO SFC 1800-2	170 lbs 77 kg	HRO SFM 1800-2	136 lbs / 62 kg

2.5 ELECTRICAL MOTOR SPECIFICATIONS

(H.P. = Horse Power; RPM = Revolutions Per Minute; FLA = Full Load Amperes;
LRA = Locked Rotor Amperes @ Start Up)



CAUTION: The Horizon Seafari Reverse Osmosis Desalination Systems are designed to be as electrically efficient as possible. RPM supplied to and Pressure created by the High Pressure Pump govern the amount of energy required by the High Pressure Pump's Electric Motor. In order to maintain a sufficient flow of feed water into the Reverse Osmosis Membrane Element, Horizon Seafari utilizes several different High Pressure Pumps with different displacement characteristics. These different High Pressure Pumps, in turn, have different power requirements.

As such, several different Electric Motors are used in the Horizon Seafari Systems. In order to maintain maximum operational versatility HRO Seafari Systems utilize dual Cycle (Hz) Electric Motors capable of operating from both 50 Hz and 60 Hz.

In a Boat application, use caution when switching from your auxiliary AC on board generator to shore power. In many cases, due to insufficient wiring or long distances from the power source to the end of the dock, shore power from a Marina may be insufficient to operate your Horizon Seafari System. Low voltage to the Horizon Seafari System causes damage to the electric motor. Damage caused to the system due to low voltage is not covered by Warranty.

HIGH PRESSURE PUMP MOTOR:

450-1 AND 900-2 SYSTEMS:

	50 Hz	H.P.			60 Hz	H.P.		
PHASE	VAC	50 Hz	FLA	LRA	VAC	60 Hz	FLA	LRA
Single	110	2.2	21	121	115	2.2	18	94
Single	220	2.2	10.5	60.5	230	2.2	9	47
Three	220	3.0	9.2	78	230	3.0	8.2	70
Three	380	3.0	4.6	39	460	3.0	4.1	35

700-1 & 1400-2 • 900-1 & 1800-2 SYSTEMS:

	50 Hz	H.P.			60 Hz	H.P.		
PHASE	VAC	50 Hz	FLA	LRA	VAC	60 Hz	FLA	LRA
Single	110	2.2	21	121	115	2.6	21.2	109
Single	220	2.2	10.5	60.5	230	2.6	10.6	54.5
Three	220	3.0	9.2	78	230	3.0	8.2	70
Three	380	3.0	4.6	39	460	3.0	4.1	35

BOOSTER PUMP MOTOR:

1/2 HP					
PHASE	Hz	VAC	H.P.	FLA	LRA
Single	50/60	115	.5	7.4	34
Single	50/60	220/230	.5	3.7	17
Three	50/60	220/230	.5	2	12
Three	50/60	380/460	.5	1	6

RECOMMENDED CIRCUIT BREAKER:

Operating Voltage Hz	Phase	Recommended Circuit Breaker Size
115 VAC	Single	35 Amperes
230 VAC	Single	15 Amperes
208/230 VAC	Three	10 Amperes
380 VAC	Three	7.5 Amperes
460 VAC	Three	7.5 Amperes



NOTE: Additional specifications to this system are provided in the Supplemental Specification Sheet. Further operation requirements are given in the Installation Section. Also, consult the Temperature vs. Production Chart near the back of this manual.

HIGH PRESSURE PUMP MOTOR WITH SOFT MOTOR START (SINGLE PHASE ONLY):

450-1 AND 900-2 SYSTEMS:

	50 Hz	H.P.			60 Hz	H.P		
PHASE	VAC	50 Hz	FLA	LRA	VAC	60 Hz	FLA	LRA
Single	110	2.2	21	54.5	115	2.2	18	42.3
Single	220	2.2	10.5	27.2	230	2.2	9	21.2

700-1 & 1400-2 • 900-1 & 1800-2 SYSTEMS:

	50 Hz	H.P.			60 Hz	H.P		
PHASE	VAC	50 Hz	FLA	LRA	VAC	60 Hz	FLA	LRA
Single	110	2.2	21	54.5	115	2.6	21.2	49.1
Single	220	2.2	10.5	27.2	230	2.6	10.6	24.5

BOOSTER PUMP MOTOR:

1/2 HP					
PHASE	Hz	VAC	H.P.	FLA	LRA
Single	50/60	115	.5	7.4	34
Single	50/60	220/230	.5	3.7	17
Three	50/60	220/230	.5	2	12
Three	50/60	380/460	.5	1	6

RECOMMENDED CIRCUIT BREAKER:

Operating Voltage Hz	Phase	Recommended Circuit Breaker Size
115 VAC	Single	35 Amperes
230 VAC	Single	15 Amperes



NOTE: Soft Motor starters are available for single phase only. The Soft Start lowers the starting torque of the high-pressure pump motor only. This reduces the locked rotor amps required to start the system. These reduced locked rotor amp values are shown in the above High Pressure Pump Motor Specifications with Soft Motor Starter.

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3

PRE-INSTALLATION NOTES

Seafari Versatile 450 - 1800

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3 PRE-INSTALLATION NOTES

3.1 COMPONENT DESCRIPTIONS

All components supplied by HRO, both standard and optional, are described below along with items required or desired by the installer. The ID numbers used correspond to the System Schematic numbers from page 3 - 2.

** Denotes items supplied by installer

*** Denotes optional equipment.

3.1.1 PRE-FILTRATION SUBSYSTEM

This section of the system pre-treats and delivers the Feed Water into the System. The Feed Water may be collected directly from the source, from a well, or through a ship's Sea Chest / Inlet Thru Hull Fitting. The raw feed water is filtered to remove suspended solids larger than 5 Micron size (5/1,000,000 of a meter). The pre-filtration protects the HRO Systems Membrane Element from undue fouling.

A plugged Pre-Filtration Subsystem causes cavitation damage to the High Pressure Pump. Always ensure that the Pre-Filtration Subsystem is clear and monitor it frequently.

1. **Inlet Thru Hull Fitting with Forward Facing Scoop** ** is the point at which the feed water enters the system. It is the installer's responsibility to arrange for and configure this feed water pick up point. If the pick up point is a thru hull fitting on a boat it must be a forward facing scoop well below water level. If the pick up is from a sea chest it must be connected at a low point in the sea chest or stand up pipe so that no air enters the system.
2. **Sea Cock Valve** ** is used in a ship installation for safety reasons to close the feed water line during non use of the Horizon Seafari System. In some installations this valve may be complemented with a check valve in order to maintain prime in the feed water line.
3. **Sea Strainer** has a clear bowl with nylon body filter housing or optional bronze body containing a cleanable monel fine mesh filter screen. The Sea Strainer filters out large particulate matter and suspended particles that would otherwise damage the Booster Pump.
4. **Rinse/Clean Inlet Valve** (optional) is used to change the system from an operational mode to a rinse, storage or cleaning mode. This valve directs water into the Booster Pump from either the raw water feed line or the Rinse/Clean Tank.
5. **Booster Pump** supplies a positive pressure to the Pre-filters, and through to the High Pressure Pump. The Horizon Seafari utilizes a pump with a performance curve of 80 Ft Head (35 psi) at 4.2 GPM. The resulting pressure at the High Pressure Pump depends on the final configuration.
6. **Plankton Filter** *** This filter assembly contains a cleanable ultra fine monel mesh screen. The mesh screen removes suspended solids or biological growth such as plankton and provides longer life to the Pre-filter Elements and in turn provide lower system maintenance costs.
7. **Multi Media Filter** *** contains a media filter bed (gravel and sand). The media traps suspended solids larger than 30 micron. The Multi Media Filter is back washable.
8. **Low Pressure Gauge, Booster Pump Outlet / Multi Media Filter Inlet** *** displays the Inlet Pressure to the Multi Media Filter. In correlation with Low Pressure Gauge [9] the operator can easily view the condition of the Multi Media Filter and determine when back washing is necessary.
9. **Low Pressure Gauge, Multi Media Filter Outlet / Cartridge Pre-Filter Inlet** *** displays the Outlet Pressure of the Multi Media Filter across the filter bed. In correlation with Low Pressure Gauge [7] the operator can easily view the pressure differential across the media and determine when back washing is necessary.
10. **Multi Media Filter Waste Connection** *** is the waste line connection to the Multi Media Filter Thru Hull Discharge Fitting.
11. **Multi Media Filter Thru Hull Discharge Fitting** ** must be provided for discharge of the Multi Media Discharge Water.
12. **Standard 25 to 5 micron Pre-Filters** consists of two filter housings connected in series with each other. The filter elements remove suspended solids from the System Feed Water. The first Pre-filter contains a filter element, which filters the feed water to 25 micron. The second Pre-filter contains a finer element, which filters the feed water to 5 micron.
13. **Future reference**

The "Cube" Contains:

- [32] High pressure Switch
- [34] Brine Flowmeter
- [41] Salinity Probe
- [42] Product Flowmeter
- [43] Diversion Valve

Horizon Seadrill Versaline Series 450-1800 US OFD
Reverse Osmosis Desalination System with ALL Options

The "Cube" Contains:
[32] High pressure Switch
[34] Brine Flowmeter
[41] Salinity Probe
[42] Product Flowmeter
[43] Diversion Valve

14. **Commercial Pre-Filter***** provides extended periods between filter element changes. The Commercial Pre-filter contains a filter element with 50 square feet of filtering area. This filter removes suspended solids 5 Microns & larger.
15. **Air Bleed** allows the operator to purge the Commercial Pre-Filter Housing of any air introduced from the feed line.
16. **Low Pressure Gauge, Commercial Pre-Filter Inlet** provides visual indication of the pressure into the Commercial Pre-filter Housing from the Booster Pump.
17. **Oil/Water Separator Filter** The separator element separates oil and suspended solids from the System Feed Water. Oil permanently destroys the R.O. Membrane Element, therefore, it is recommended that the user avoid operating the Horizon Seafari in oily, polluted waters.
18. **Air Bleed Valve** allows the operator to purge the Oil Water Separator Filter Housing of any air and collated oil introduced from the feed line.
19. **Low Pressure Gauge** displays the Inlet Pressure to the High Pressure Pump. The gauge assists the operator in diagnosing the Sea Strainer, Booster Pump, Plankton Filter Element, Commercial Prefilter Element, and Oil/Water Separator Element condition.
20. **Low Pressure Switch** shuts the System off automatically when a plugged filter element or other condition causes a low flow situation. This protects the High Pressure Pump, the R.O. Membrane Element and the Booster Pump from damage.
- 21-23 **Future reference**
24. **Future Reference**
25. **Electric Motor** is directly coupled to the High Pressure Pump. Single Phase Systems utilize specially designed electric motors, which include a thermal overload protection switch which shuts the System off due to low voltage or over loading.
26. **High Pressure Pump** is a marine quality, positive displacement, ceramic plunger pump. The High Pressure Pump lasts for years with proper use and maintenance.
27. **High Pressure Hose, HP Pump Outlet MVA Inlet** transfers pressurized Sea Water from the High Pressure Pump to the inlet of the R.O. Membrane Element.
- 28, 29 **R.O. Membrane Element & Vessel The Membrane Element** allows potable water molecules to pass through while rejecting the salt ions. Only about 10% of the System Feed Water becomes fresh Product Water (per membrane element). The remainder carries the rejected salt ions out of the R.O. Membrane Element in a concentrated brine stream.
31. **High Pressure Gauge** displays the R.O. Membrane Vessel outlet pressure.
32. **High Pressure Switch** is used to automatically turn the System off in case of over-pressurization during operation.
33. **Back Pressure Regulator** By turning the valve adjustment handle clockwise and counterclockwise pressure is increased and decreased accordingly. This increases and decreases the production capability of the R.O. Membrane Element.

3.1.3 BRINE DISCHARGE SUBSYSTEM

This section of the System carries the Brine Discharge expelled from the R.O. Membrane Element back to the feed source.

34. **Flow Meter, Brine Discharge Water** measures Brine Flow of the System and is located on the left side of the dual port Brine/Product Water Flow Meter. This is one of the most important visual checkpoints of the HRO system and should be monitored on a regular basis.
35. **Clean/Rinse Outlet Valve** (optional) is used in conjunction with the Clean/Rinse Inlet Valve to set the System Brine Discharge Line into a normal, storage or cleaning mode.
36. **Thru Hull Discharge Fitting **** should be installed above water level for discharge of the Brine Discharge Water from the System.
37. - 39. **Future Reference**

3.1.2 PRESSURIZATION SUBSYSTEM

Proper pressure and proper flow across the HRO Systems Membrane Element are two basic requirements of Reverse Osmosis. Refer to Section 2 for correct flow specifications and to the Temperature Effect Chart in Section 12 of this Manual for temperature corrections.

24. **Future Reference**
25. **Electric Motor** is directly coupled to the High Pressure Pump. Single Phase Systems utilize specially designed electric motors, which include a thermal overload protection switch which shuts the System off due to low voltage or over loading.

3.1.4 PRODUCT WATER MONITORING SUBSYSTEM

This section of the System gives a visual indication of the clarity, quantity, and quality of the product water. Post Filtration of the HRO system is the final step in Product Water quality control. The Post Filtration Subsystem is designed to limit unpleasant odor, taste, and biological matter, which may have passed through the R.O. Membrane Element.

40. Future reference

41. **Temperature Compensated Salinity Probe** electrically determines whether the salinity content of the Product Water is acceptable. This Salinity Probe compensates for water temperature variations, and provides an accurate measurement of the quality of the Product Water.
42. **Flow Meter, Product Water** The flow-through design of the meter allows it to measure the rate of Product Water flow from the R.O. Membrane Element toward the Product Water Post Filtration Components.
43. **3-Way Electric Product Diversion Valve** the Controller energizes this valve to the "Potable" position when the system produces water, which meets or exceeds the salinity requirement. If the Product Water being produced is "Un-potable" then no signal is sent to the valve and it thus remains in the normally open position. The normally open position diverts the un-potable Product Water to discharge.
44. **Charcoal Filter***** is designed to assist in the removal of foul odors from the Product Water.
45. **Ultra Violet Sterilizer***** destroys at least 99.9% of any virus, bacteria and other micro-organisms which may pass through the HRO R.O. Membrane Element. The U.V. sterilizer is highly recommended if the Product Water Storage Tank is not otherwise treated by means such as chlorination. Use of the U.V. Sterilizer is also recommended if the System Feed Inlet is near a polluted source such as a raw sewage outlet.
46. **Potable Water Storage Tank**** may be any container suitable for storing Potable Water, i.e. existing water storage tank.
47. **Ships Fresh Water Pressure System**** is the existing pumping/pressurizing system for distribution of the fresh water on to all of the various faucets and fixtures.

48,49 Future Reference

3.1.5 RINSE & CLEAN TANK SUBSYSTEM

Consists of supplied valves and required tank or container for the cleaning, rinsing or storage of the R.O. System. The Horizon Seafari should be rinsed, stored, and cleaned from time to time or as appropriate.

50. **Rinse/Clean Tank**** is any container, permanent or temporary, which can hold from 5 to 20 gallons of water.
51. **Check Valve, Non Return**** is desired if Valve [52] is used for Dock Side water flushing of the System. This valve prevents Dock Side Rinse Water from entering the Clean/Rinse tank.
52. **Filtered Dock Water Isolation Valve**** controls the flow of Dock Side rinse water.
53. **Fresh Water Flush Charcoal Filter and Solenoid Valve***** is the main component of the optional Fresh Water Flush System, which flushes the system with fresh water. The Solenoid Valve controls the flow of fresh water through the system. The charcoal filter removes particulate matter and chlorine from the fresh water to prevent damage to the R.O. membrane element(s). Fresh Water Flushing replaces the seawater in the system with less corrosive fresh water.
54. **Fresh Water Flush Check Valve Assembly***** This check valve assembly isolates the Fresh Water Flush system, preventing seawater from flowing in the reverse direction through the Charcoal Filter.

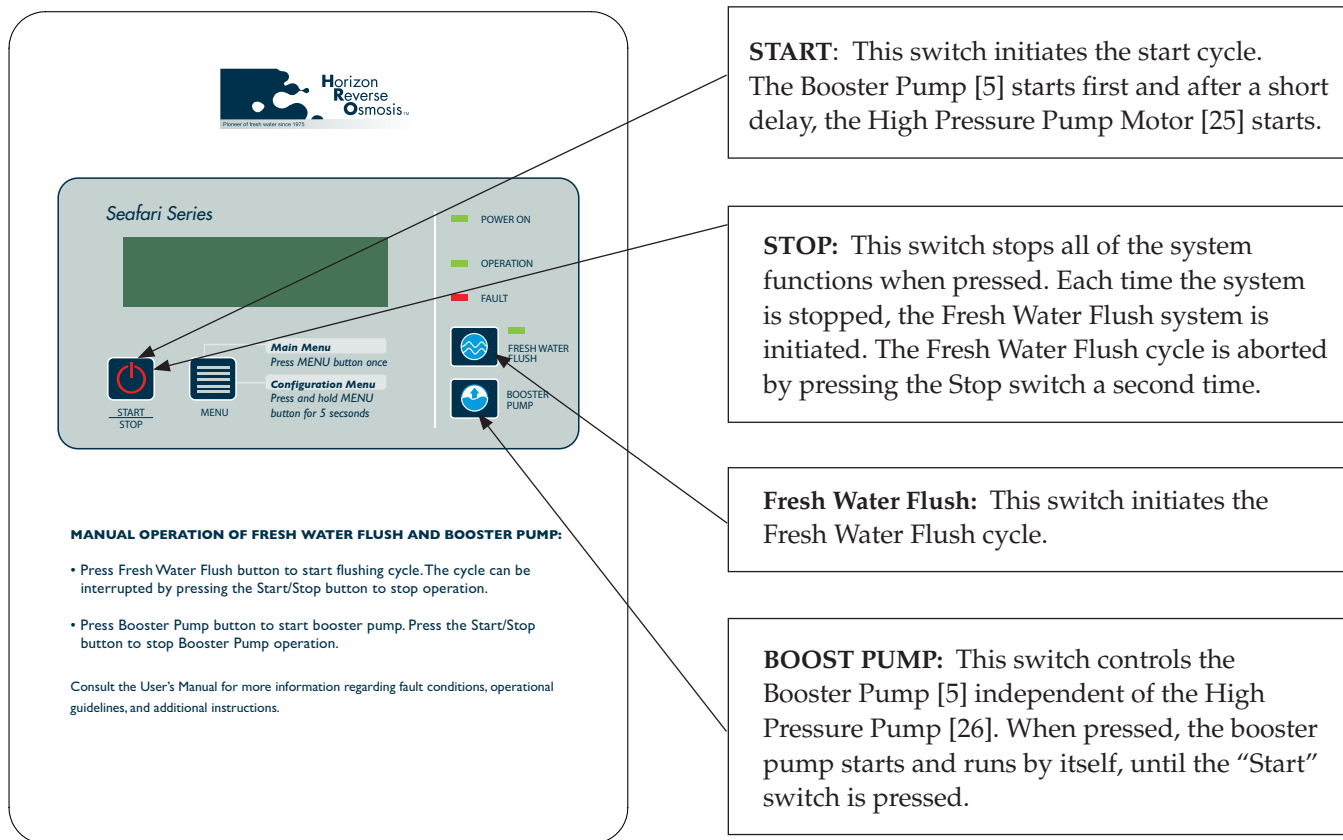
3.1.6 ELECTRONIC SUBSYSTEM

This subsystem measures water quality, controls the direction of Product Water flow, and contains the central electrical connection point of the System. It also ensures only potable Product Water passes into the Product Water Storage Tank.

55. **Remote Controller***** (optional) allows remote monitoring and or controlling of the system.

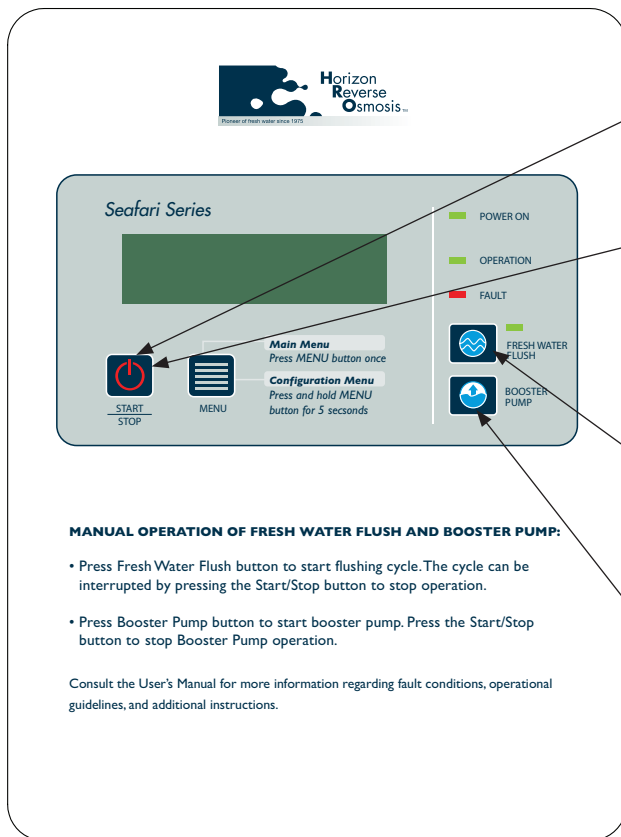
Touch Pad Control Description

- A. **Switches** The Touch Pad contains all of the system control switches. The system switches are identified and described below.



- B. **Indicator Lamps** Above and to the left of the switches on the Touch Pad are the indicator lamps. These lamps either indicate the operation of the corresponding equipment or a fault condition. The following are descriptions of the indicator lamps.

3



START: This switch initiates the start cycle. The Booster Pump [5] starts first and after a short delay, the High Pressure Pump Motor [25] starts.

STOP: This switch stops all of the system functions when pressed. Each time the system is stopped, the Fresh Water Flush system is initiated. The Fresh Water Flush cycle is aborted by pressing the Stop switch a second time.

Fresh Water Flush: This switch initiates the Fresh Water Flush cycle.

BOOST PUMP: This switch controls the Booster Pump [5] independent of the High Pressure Pump [26]. When pressed, the booster pump starts and runs by itself, until the "Start" switch is pressed.

3.1.7 OPTIONAL EQUIPMENT

- Soft Start*** The soft start lowers the starting torque of the high-pressure pump motor, and gradually brings the motor to full speed. This reduces the initial startup amps required to start the motor. The soft start is available on single-phase systems and allows starting of the system when the power/source, i.e. generator, is marginal or insufficient to start the system unassisted. By reducing the starting torque of the motor, the system demands lower initial power at startup and can operate on an otherwise insufficient power source.

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4

SYSTEM INSTALLATION

Seafari Versatile 450 - 1800

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4 SYSTEM INSTALLATION

4.1 ON SITE STORAGE AND PREPARATION FOR INSTALLATION

4.1.1 STORAGE PRIOR TO UNCRATING

1. Adhere to crate markings:
 - DO NOT store in direct sunlight;
 - DO NOT store above 120 degrees F / 50° C
 - DO NOT freeze; STORE ONLY on base with ARROWS UP
 - DO NOT store longer than 3 months without additional storage chemical rinsing.
2. Refer to Section 8 of this manual for further cautions of the R.O. Membrane Element.

4.1.2 AVOID CHEMICAL ATTACK TO THE SYSTEM



CAUTION: Do not expose the Horizon Seafari System to:

- hydrogen peroxide
- chloramine
- chloramine-T
- N-chloroisocyanurates
- chlorine dioxide
- hypochlorite,
- chlorine
- iodine
- bromine
- bromide
- phenolic disinfectants

or any other specific chemical not approved in writing by HRO Systems. Use of unauthorized or misuse of authorized chemicals voids system warranty.



NOTE: Numbers in [brackets] refer to the I.D. numbers illustrated on page 3-2 or 4-5.

4.1.3 COMPONENTS SUPPLIED BY OWNER:

1. **Inlet Thru Hull Fitting with Inlet Sea Cock Valve [1&2]**
 - ¼ - turn ball valve min. ¾" size, with a ¾" MNPT connection for the supplied HRO fitting.

This inlet must be installed below water level and must never be able to draw air.

The system intake must be located toward the bottom when a stand up pipe is used.

2. **Brine Thru Hull Fitting [36]**

- A minimum ½" size with a ½" MNPT connection.
- Must be located above water level.
- If a Multi-Media Filter is installed, an additional waste fitting, minimum ½" size with ½" MNPT for connection to the supplied HRO fittings.

3. **Potable Water Storage Tank [46]**

- The installation fitting must be at least a 3/8" NPT with 3/8" FNPT for connection of the HRO fittings.
- The fitting must terminate above the maximum water level.
- No valves should be installed in this line.

4. **Properly Sized Power Cable:**

Operating Voltage 115 VAC, Single Phase,
Recommended Minimum Size Power Cable:
10 AWG

Operating Voltage 230 VAC, Single Phase,
Recommended Minimum Size Power Cable:
12 AWG

Operating Voltage 230 VAC, Three Phase,
Recommended Minimum Size Power Cable:
12 AWG

Operating Voltage 380-460 VAC, Three Phase,
Recommended Minimum Size Power Cable:
14 AWG

5. **An electrical power source** capable of supplying the proper current at the proper Voltage to the Horizon Seafari System.

4.1.4 TOOLS REQUIRED FOR INSTALLATION

Of course, not all installations are typical. For this reason, it is recommended to have a full set of mechanic's electrician's tools available. However, no special system tools are required for installation. Though not always necessary, a separate DS Meter, available from HRO Systems, and a volt/ohm meter (VOM) are beneficial and useful tools for system installation and initial start-up.

4.1.5 SPECIAL CONSIDERATIONS

1. Length of connection lines

- All connection lines should be as short as possible. Increased length causes line-loss from the system.
- The connection lines must be as straight as possible with minimum number of fittings.

2. Placement and routing of the feed line

- Always plumb the line so that all air may naturally bleed from the feed water line. (Excessive bends and elbows in the Feed Line results in pressure loss)
- Pressure losses cause inefficiency and shorter prefilter life.

3. System feed inlet

- Must be in constant contact with the feed water.
- The Horizon Seafari system must receive an uninterrupted supply of air free feed water.
- The Inlet Thru Hull Fitting should be dedicated for only the Horizon Seafari R.O. System.
- DO NOT use one Thru Hull Fitting for several auxiliary systems.

4. Access for maintenance

- Give careful consideration to access to items for maintenance purposes.
- Hidden or out of reach items may become forgotten and cause damage to other system components.

5. The Control Panel

- Must be accessible for operation & viewing.

loss from the Booster Pump causes shorter Pre-filter Element life.

Keep the distance from the Sea Cock valve to the High Pressure Pump as short and straight as possible.

Non-Standard applications may require a larger booster pump. This is determined best by the installer prior to system purchase.

2. Brine Dump Tubing from the System to the Brine Discharge Outlet Fitting [36]:

20 feet of 1/2" OD (15 meters of 12.7 mm OD) tubing is supplied to connect the Brine Discharge Line components.

Ensure that no back pressure is present on this line as backpressure causes bypassing at the 3-way product water diversion valve.

3. Product water tubing from the Product Water outlet connection to the Product Water Storage Tank Inlet [46]:

50 feet of 3/8" OD (15 meters of 9.5 mm OD) tubing is supplied for this purpose.

Keep the product water tubing as straight and short as possible.



CAUTION: Do Not Install Any Valves in this line. Blockage of the Product Water Line causes extensive damage to the System and the R.O. Membrane Element.

4.1.7 UNCRATING



CAUTION: Do not discard any packaging material until you have found and identified all parts!

Remove the Horizon Seafari system from the shipping crate.

Some of the components are loose or separately packaged in the shipping container.

Do Not discard any packaging or boxes as they may contain small mounting hardware pieces or small system components.

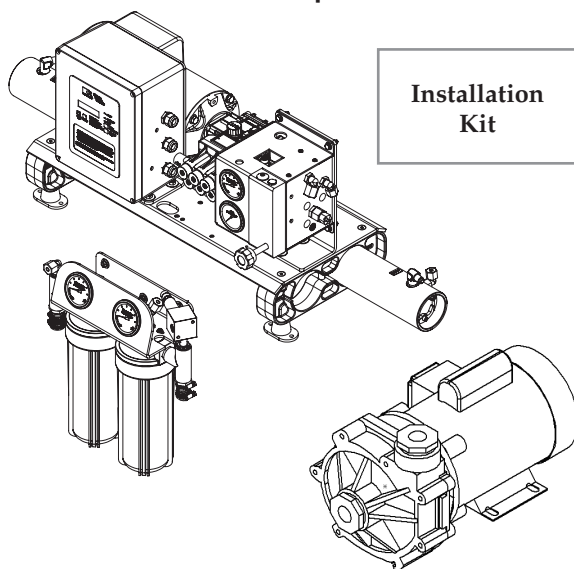
4.1.6 DISTANCE BETWEEN COMPONENTS

1. Inlet Sea Cock Valve [2] through the Pre-filtration and into the inlet of the High Pressure Pump:

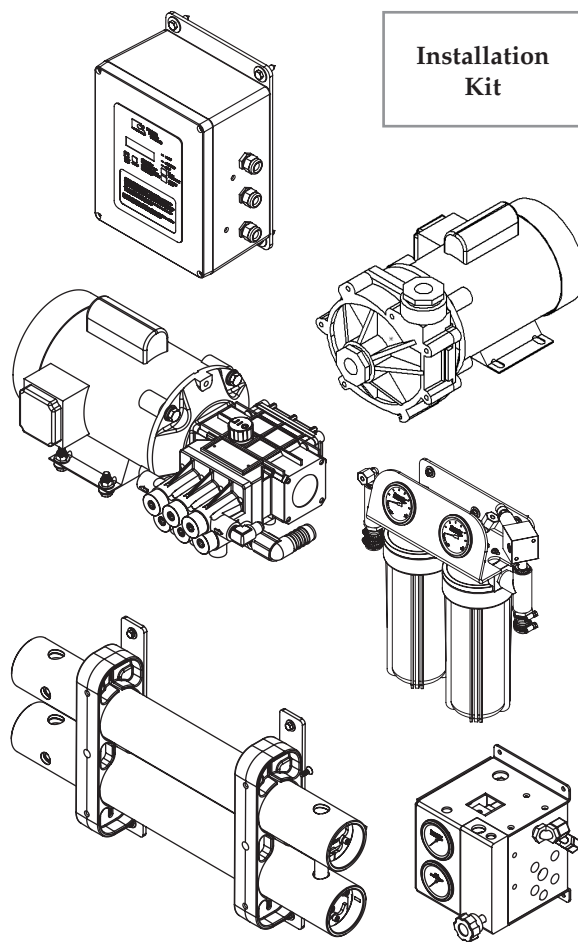
12.5 feet of 3/4" I.D. (3.8 meters of 19 mm ID) flexible rigid wall tubing is supplied for the plumbing of the feed water line from the Inlet Sea Cock to the Inlet of the High Pressure Pump.

Caution must be exercised in extending the length of the feed water line. Feed pressure

Self Contained System - Packaged Components (without options)



Modular System - Packaged Components (without options)



4.1.8 HIGH PRESSURE PUMP PREPARATION

1. Remove the orange shipping plug from the high pressure pump and replace with the orange, vented cap.

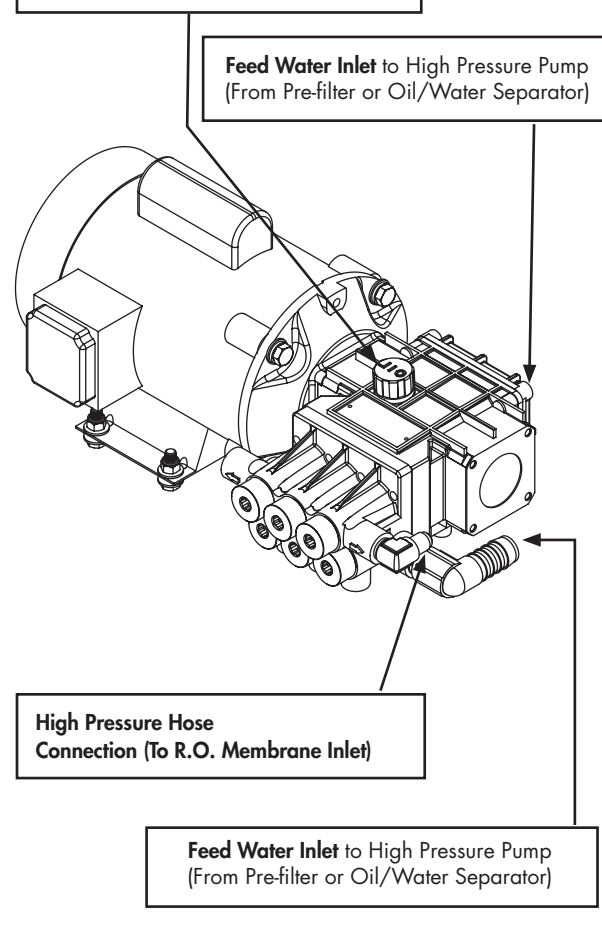
CAUTION: It is very important that the vented cap is installed or pressure builds up within the pump crankcase, which may lead to pump damage

2. Ensure that the pump oil level is at the center of the pump sight glass.

The pump oil must be filled with HRO Systems supplied pump oil.

High Pressure Pump Illustration

Supplied Orange-Colored Vented Oil Fill Cap MUST Be Installed Prior to Use.



4.2 TUBING CONNECTIONS

1. Assembly

Step 1: Cut tube end square and clean

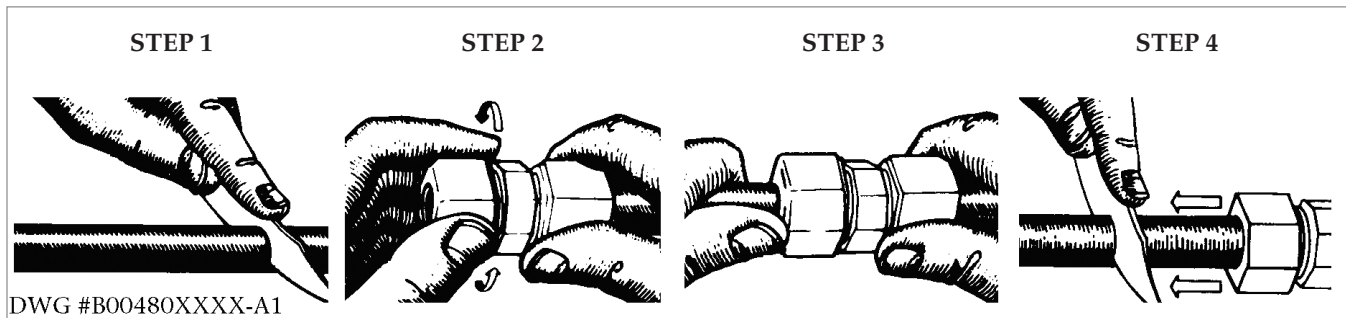
Step 2: Loosen nut on fitting three turns.

Step 3: Insert tube into fitting until it bottoms. Loosen nut completely and remove tube with attached parts from body. Check to ensure that the "O"-ring is seated onto the tube under the spacer (and not pinched into the body). Insert tube with attached parts into the body and tighten nut finger tight.

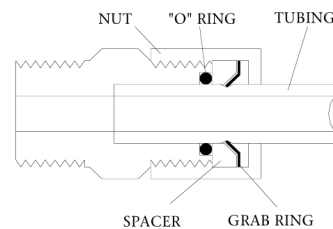
2. Disassembly

Step 4: To remove tubing in order to reuse the fitting assembly, cut tubing close to nut, push tubing through nut, grab ring and spacer.

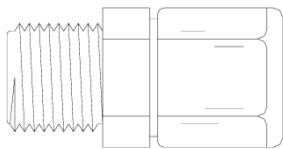
Fast-N-Tite Tubing connection



NOTE: Always allow the tube to enter and exit straight from the tube fitting for a minimum of one inch prior to starting a bend. If the tube is immediately bent from the tube fitting then leaks result due to unnatural O-ring side compression.

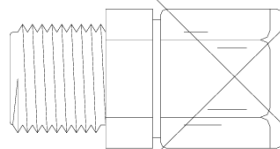


Fast-N-Tite Tube Fitting



CORRECT:
Straight and Parallel
with the Fitting for
at least 2 inches (5 cm)

Fast-N-Tite Tube Fitting



WRONG:
This will cause
air suction leaks
and water leaks

The "Cube" Contains:

- [32] High pressure Switch
- [34] Brine Flowmeter
- [41] Salinity Probe
- [42] Product Flowmeter
- [43] Diversion Valve

Reverse Osmosis Desalination System with ALL Options

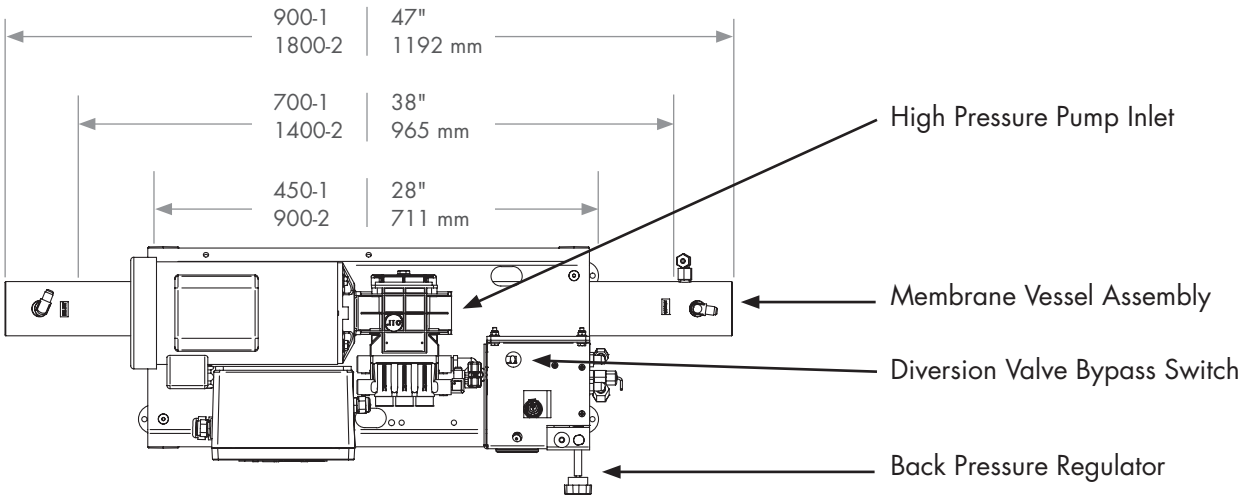
The "Cube" Contains:

- [32] High pressure Switch
- [34] Brine Flowmeter
- [41] Salinity Probe
- [42] Product Flowmeter
- [43] Diversion Valve

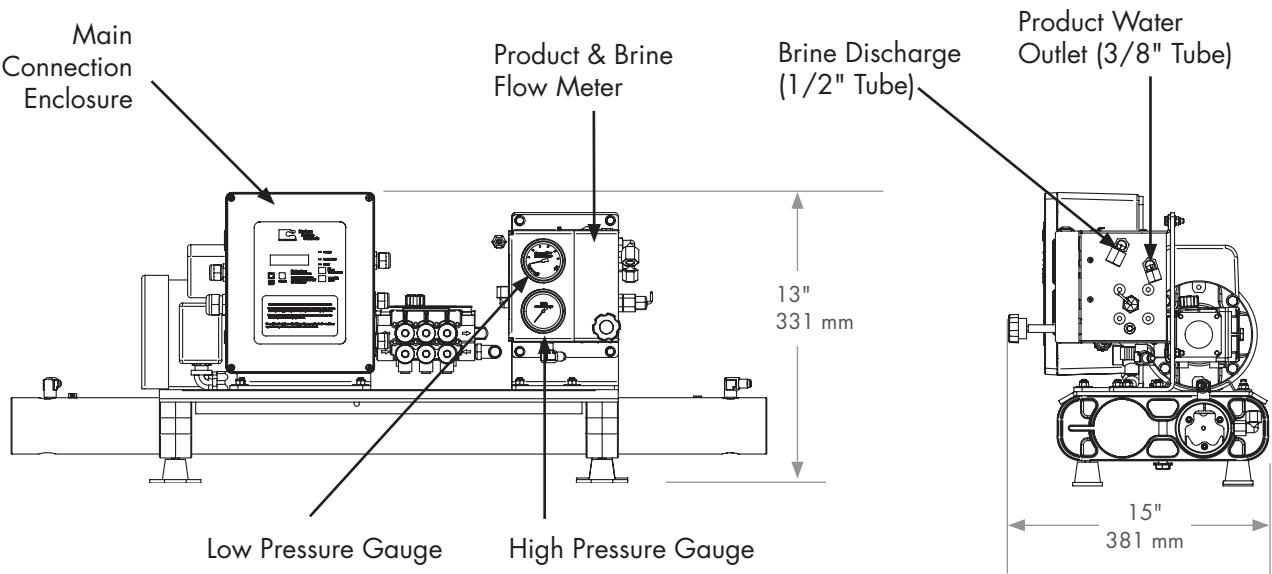
4.3 SEAFARI COMPONENTS IDENTIFICATION & DIMENSIONS

4.3.1 SEAFARI VERSATILE - SELF CONTAINED

MODEL | WIDTH



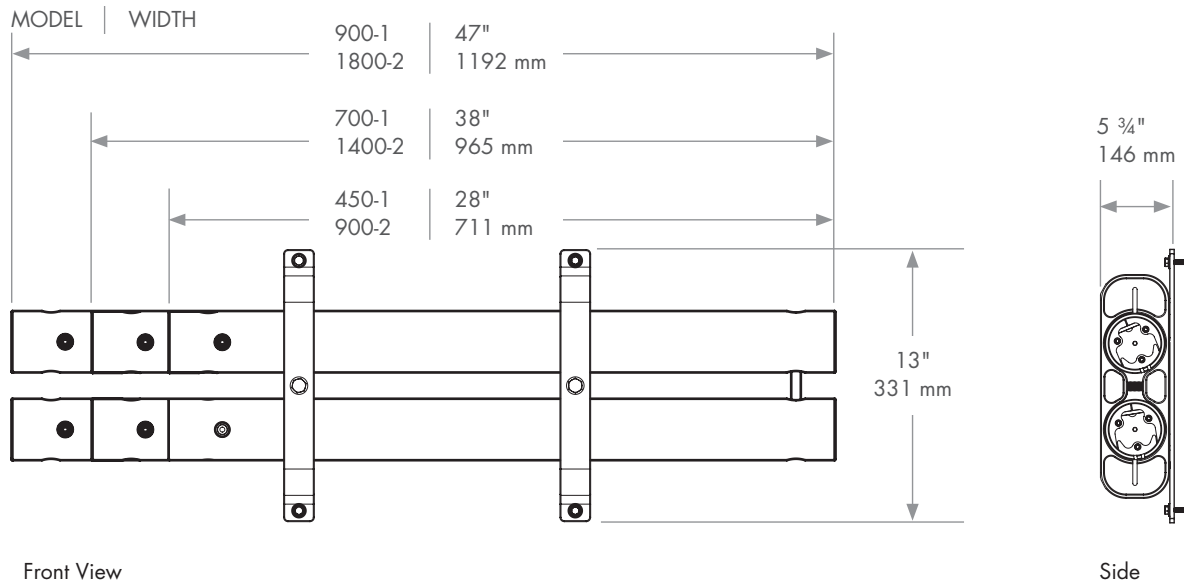
Top View



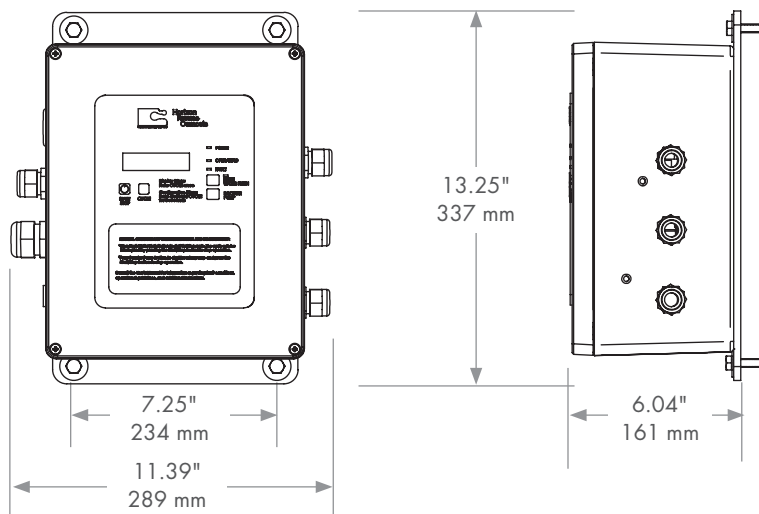
Front View

4.3.2 SEAFARI VERSATILE - MODULAR

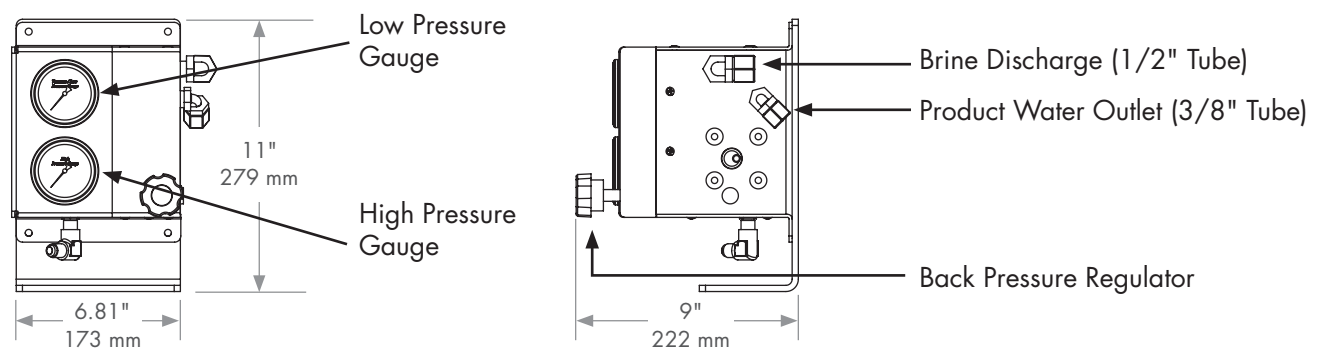
Membrane Vessel Assembly



Main Connection Controller

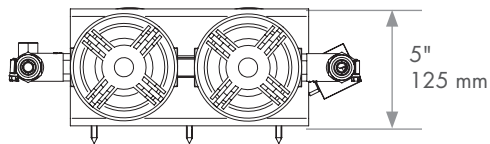


Remote Cube

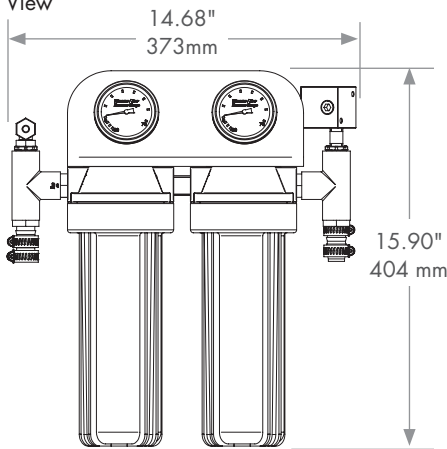


4.3.3 PRE-FILTERS

Top View

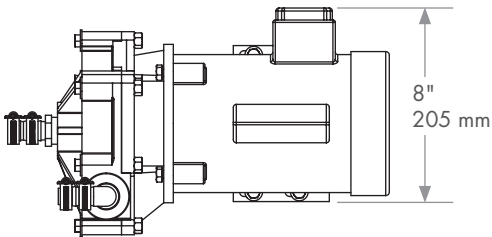


Front View

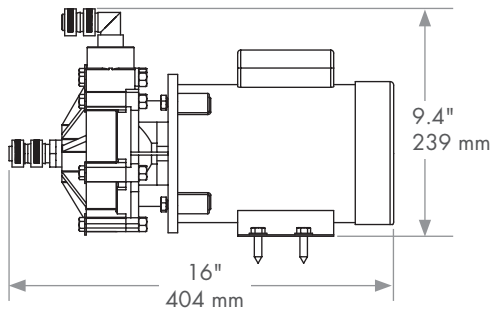


4.3.5 BOOSTER PUMP

Top View

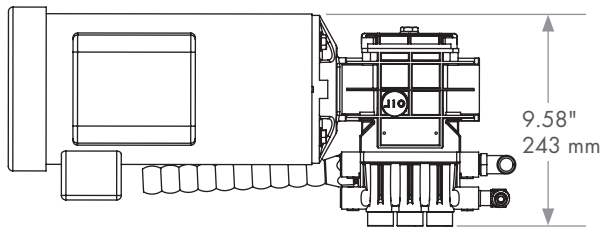


Front View

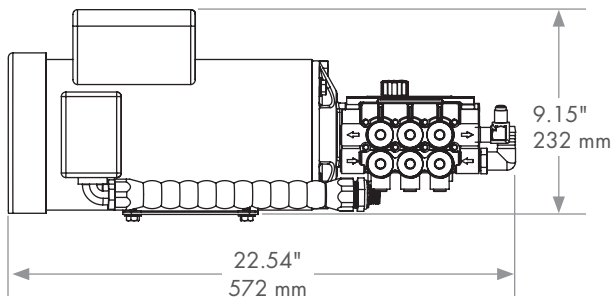


4.3.4 GP HIGH PRESSURE PUMP (Standard)

Top View

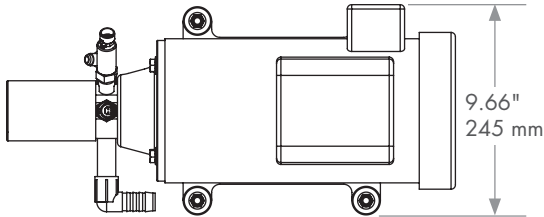


Front View

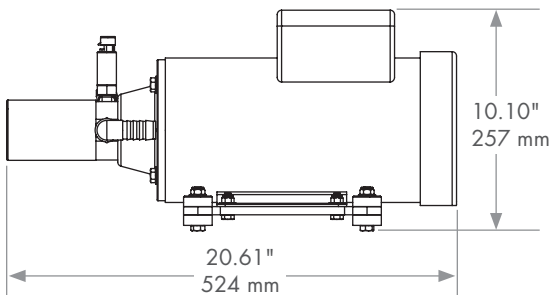


4.3.6 RADIAL AXIAL HIGH PRESSURE PUMP (Optional)

Top View

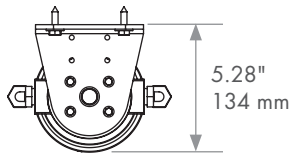


Front View

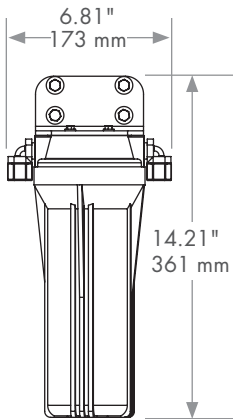


4.3.7 CHARCOAL FILTER

Top View

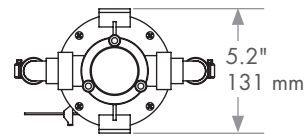


Front View

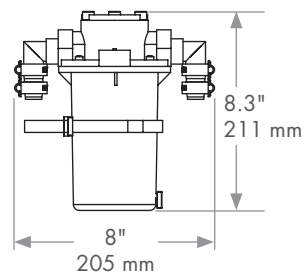


4.3.9 SEA STRAINER

Top View

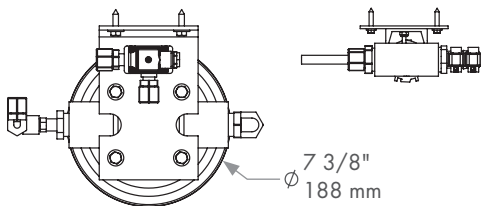


Front View

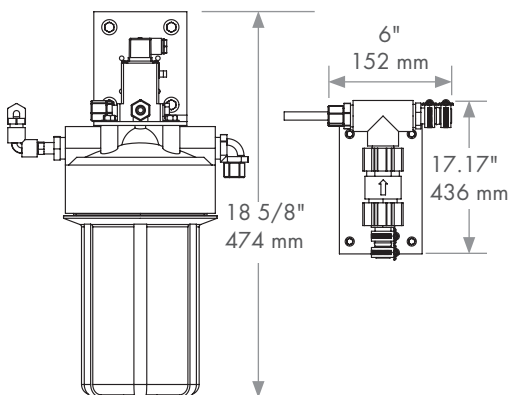


4.3.8 FRESH WATER FLUSH

Top View

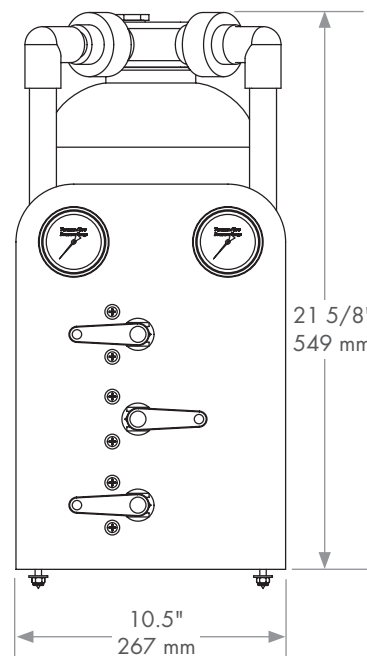


Front View

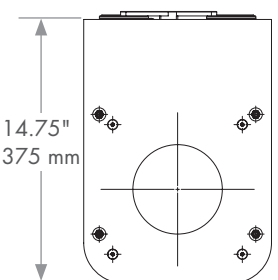


4.3.10 MULTI-MEDIA FILTER

Front View

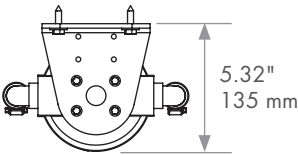


Bottom View

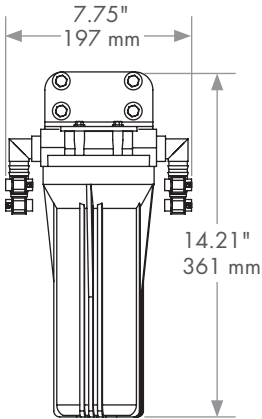


4.3.11 PLANKTON FILTER

Top View

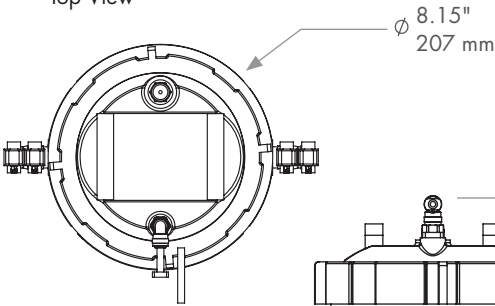


Front View

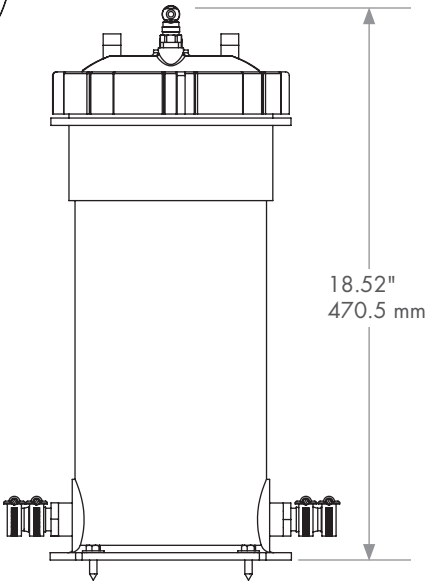


4.3.13 COMMERCIAL PRE-FILTER /
OIL WATER SEPARATOR

Top View

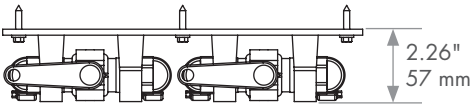


Front View

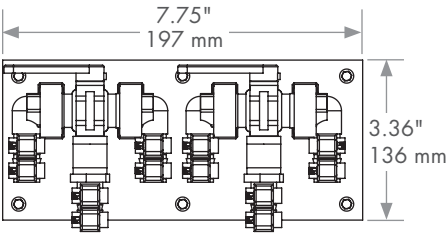


4.3.12 CLEAN AND RINSE PANEL

Top View



Front View



4.4 COMPONENT INSTALLATION



INSTALLATION CAUTIONS

DO NOT over tighten PVC fittings. If threaded pipe fittings leak after installation then remove the fitting, clean the male mating threads, apply 3 to 4 wraps of Teflon tape to the male threads and then thread the parts back together.

The Inlet Connection [1], Sea Strainer [3], Inlet Clean/Rinse Valve [4] and Booster Pump [5] must be mounted below water level to operate properly.

REMOVE ALL TUBE SHIPPING PLUGS FROM THE RIGHT SIDE OF THE HORIZON SEAFARI.

Always use 2 supplied Hose Clamps at each connection to secure the hose to its respective Hose Barb Fitting and seal it from leaks.

Always allow the tube to enter and exit straight from the tube fitting for a minimum of one inch prior to starting a bend.

DO NOT tie or tee the Horizon Seafari System Feed Line into another line that already feeds another auxiliary system.

DO NOT tie or tee another auxiliary system into the Horizon Seafari System Feed Line.

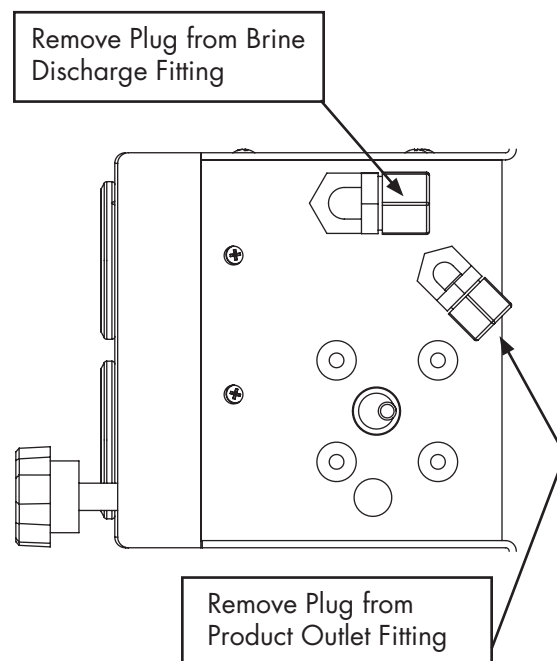
DO NOT mount the R.O. Membrane assembly in areas with temperatures above 120°F / 40 C or in freezing temperatures. Do not mount the MVA in areas exposed to radiant heat above 120° F / 40 C.

Avoid skin and eye contact with the storage solution the membrane is packaged in. In case of skin contact, rinse the skin thoroughly with water. In case of eye contact, flush repeatedly with water and notify a physician immediately.

1. Inlet Thru Hull Fitting [1] with Inlet Sea Cock Valve [2]

The Sea Cock Valve [2] must be fitted with 3/4" MNPT (Male National Pipe Taper, i.e. American Standard Tapered Pipe Thread) at the Sea Cock Valve's outlet.

The Thru Hull Fitting must be located well below the water line so the inlet remains in constant contact with the feed water even while vessel is under way.



NOTE On the rear of the control manifold there is a pigtail which is connected to the low pressure gauge. Connect this pigtail to the outlet of the final filter prior to the high pressure pump.

It must be of a forward facing scoop type. The Sea Cock Valve, 1/4" turn ball valve, normally attached to the Thru Hull Fitting must be accessible for daily and emergency closure.

If the Intake is from a Sea Chest or Stand Up Pipe then the connection must be made low, close to the hull, in order to avoid air from entering the Horizon Seafari System Feed Line.

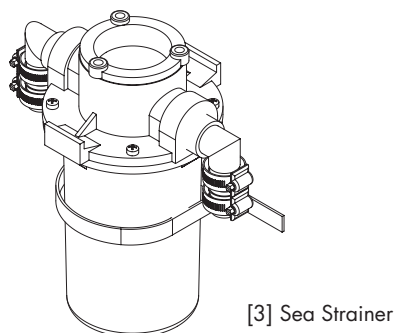
2. Inlet Connection

This fitting, supplied in the installation kit, is a 3/4" FNPT (Female National Pipe Taper,

American Standard Tapered Pipe Thread) PVC 90° elbow with a ¾" Hose Barb fitting.

Attach to the Thru-Hull fitting and align the outlet of the fitting so that it points toward the Sea Strainer [3] inlet.

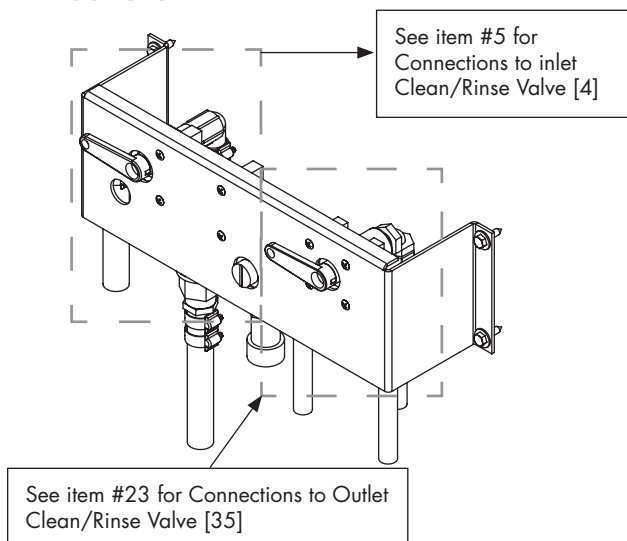
3. **Sea Strainer** [3] (optional) must be mounted well below water level.



Allow a minimum of 4" (50mm) clearance below the bottom of the bowl for screen removal. Connect the Outlet of the Sea Cock Valve to the Inlet of the Sea Strainer.

4. **Clean/Rinse Panel** (optional) with Inlet Clean/Rinse Valve [4], Outlet Clean/Rinse Valve [35], and Garden Hose Valve for Pressurized Fresh Water Rinse Connection:

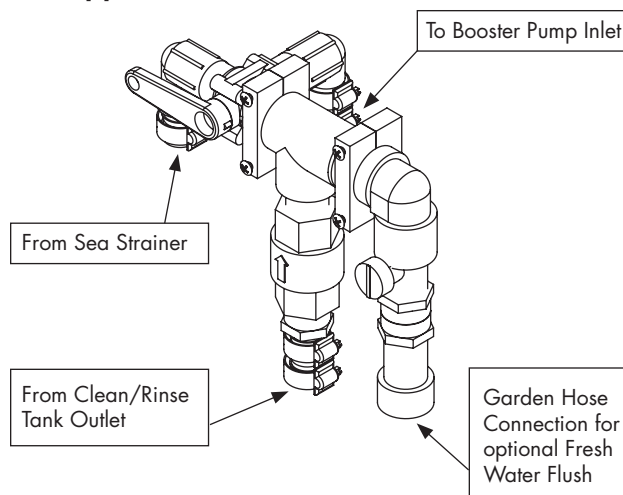
[4] & [35] Clean/Rinse Panel



This valve panel assembly replaces the individual Clean/Rinse Valves. See Items 5 and 24 in this section for plumbing instructions.

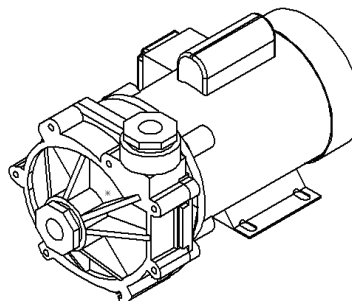
5. **Inlet Clean/Rinse Valve** [4] (optional) This valve, when used in conjunction with the Outlet Clean/Rinse Valve [35], assists in rinsing and cleaning of the System.

[4] Inlet Clean/Rinse Valve



Install between the Sea Strainer and the Booster Pump in an area that is accessible. The Valve may be directly mounted to the Outlet Port of the Sea Strainer or the Inlet Port of the Booster Pump. If used, connect one side port of the Inlet Clean/Rinse Valve to the Outlet of the Sea Strainer. Connect the other side port to a Clean/Rinse Tank [50] or to a length of hose that can later be placed into a temporary Clean/Rinse Tank, Container or Bucket. Connect the Center (common) port to the Inlet of the Booster Pump [5].

6. **Booster Pump** [5]

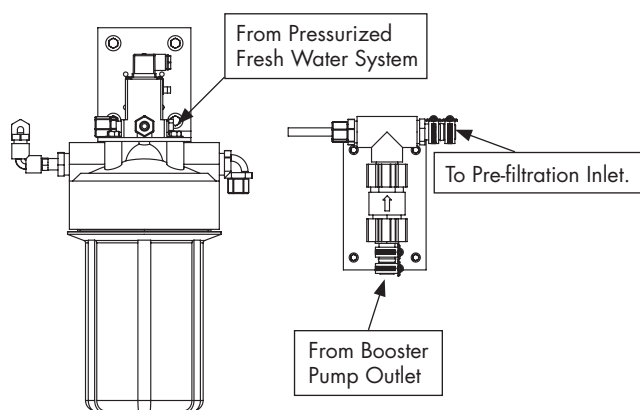


The Booster Pump is a centrifugal pump and it is not self-priming. The booster pump volute must be fully filled with water in order for the booster pump to operate properly. Any air present in the pump prevents the water from flowing. Mounting the booster pump below water level ensures that air never enters the booster pump volute. For best results, install

the Booster Pump Below Water Level and close to the Sea Strainer, if installed.

The Booster Pump may be mounted either horizontally or vertically. If mounted vertically, the Wet End MUST be mounted DOWN (on bottom). If mounted vertically (with the wet end on top) the motor may develop an electrical short should the wet end of the Booster Pump leak. Connect the Booster Pump inlet to the Sea Strainer Outlet or Sea Cock valve, or if the Inlet Rinse/Clean Valve is installed then connect the Booster Pump Inlet to the Center (common) port of the Inlet Clean/Rinse Valve [4]. Keep this line as short and straight as possible. Avoid up and down loops, 90° elbows, and hose kinks.

7. **Fresh Water Flush Assembly [53 & 54]*****

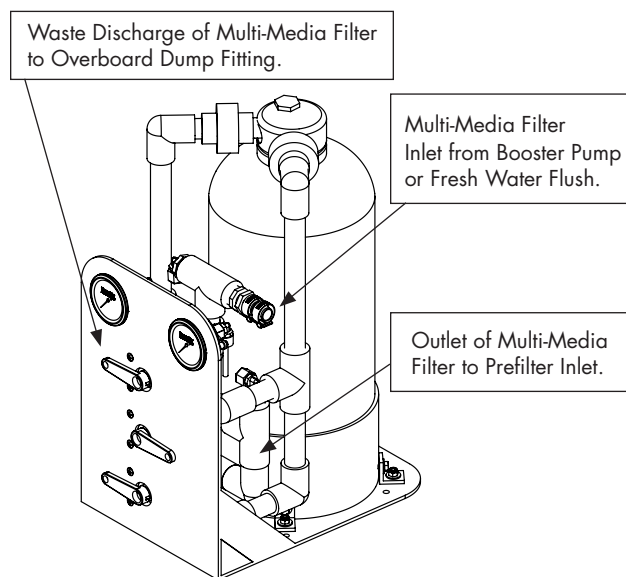


May be installed anywhere in the feed line. However, for optimum rinsing results this Check Valve Tee must be plumbed into the Feed Water Line immediately after the Booster Pump outlet. Mount the Fresh Water Flush System with the mounting hardware included in the kit. With the supplied $\frac{3}{4}$ " I.D. Hose connect the Inlet port of the Check Valve (bottom port) to the Outlet of the Booster Pump. With the supplied $\frac{1}{4}$ " O.D. tube connect the solenoid valve inlet to the existing pressurized fresh water system.

8. **Plankton Filter [6] (optional)**

Must be mounted against a flat vertical surface using the supplied mounting brackets and hardware. Mount the assembly below water level to minimize feed pressure loss. Allow minimum 4" below the bottom of the bowl for mesh screen element removal. Connect the inlet to the Booster Pump Outlet or the Fresh Water Flush Outlet.

9. **Multi Media Filter [7] (optional)** is supplied pre-mounted to its own base. Mount the Multi Media Filter base onto a flat horizontal surface and secure the base in place using the supplied mounting hardware. Mount the assembly below water level to minimize feed pressure loss.



Connect the inlet to the Booster Pump Outlet or Fresh Water Flush Outlet.

Connect the Outlet to the Commercial Pre-filter Inlet. Connect the Media Filter Waste Discharge Fitting [10] to the Over Board Dump Waste Fitting [11].

Unscrew the Multi Media Fill Plug, located on top of the Multi Media Filter Lid. Place a funnel over the Fill Hole. Pour into the funnel approximately 15 lbs (7 kg) of small gravel ($1/8 \times 1/4$ inch) first (on the bottom) then approximately 26 lbs (12 kg) of #20 silica sand last (on top of the small gravel). Remove the funnel and clean the Fill Plug female threads. Screw the Fill Plug back onto the Lid and tighten lightly with a wrench. Note this Fill Plug is O-ring sealed and requires only light tightening to seal the O-ring.

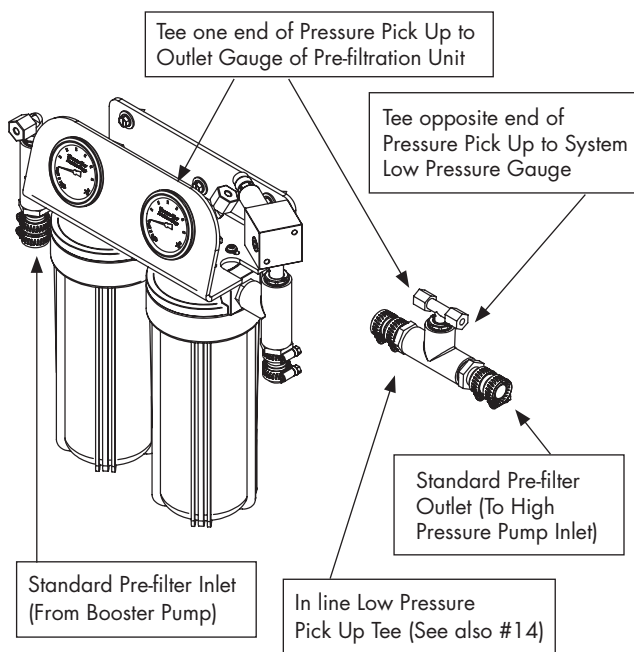
Backwash Multi-Media Filter before operating the system.

10. **Standard Pre-filter [12]:**

Must be mounted against a flat vertical surface using the supplied hardware.

It is preferable to mount the Standard Pre-filters in a straight line with and in close proximity to the Booster Pump.

Allow minimum 4" below the bottom of the bowl for Pre-filter Element removal.



See also Item #14 (page E – 16) for close up of the Low Pressure Pick Up Tee.

Connect the Booster Pump Outlet (or Plankton Filter Outlet if used or Multi Media Filter Outlet if used) to the Pre-filter Inlet.

If the Oil/Water Separator is not used then connect the Standard Pre-filters Outlet to the High Pressure Pump Inlet.

11. **Commercial Pre-filter** [14] replaces the Standard Pre-filters.

It is not necessary to use both the Commercial Pre-filter and Standard Pre-filters.

The Commercial Pre-filter, must be positioned on a firm, flat surface and mounted in place with the supplied hardware.

Allow 12 inches above the Commercial Pre-filter assembly for filter element removal.

Connect the Commercial Pre-filter Inlet Port to the Booster Pump Outlet (or Plankton Filter Outlet if used or Multi Media Filter Outlet if used).

12. **Oil/Water Separator** [17] follows the Commercial Pre-filter.

The Oil/Water Separator Assembly is plumbed for water flow in the opposite direction as the Pre-filter.

Using the supplied 3/4" hose, connect the Oil/Water Separator Inlet to the Standard or Commercial Pre-filter Outlet.

Connect the Oil/Water Separator Outlet to the High Pressure Pump Inlet.

NOTE (Refer to pg. 4-15.): The Oil/Water Separator utilizes the same filter housing as the Commercial Prefilter. However, the Oil/Water Separator is plumbed opposite of (backwards from) the Commercial Prefilter. The standard filter housings have raised arrows and lettering molded indicating correct flow for the Commercial Prefilter. These markings are INCORRECT for the Oil/Water Separator. The Oil/Water Separator's correct water flow enters the center core of the filter element and migrates to the outer surface of the filter element.

13. **Self-Contained / Modular System Mounting**

Must be readily accessible for daily operation and periodic maintenance.

Components within the system must be readily access able for maintenance.

Ensure that all tubing and hoses are routed without kinks or sharp bends.

Mount the System on a firm flat surface and secure in place.

Modular System mounting:

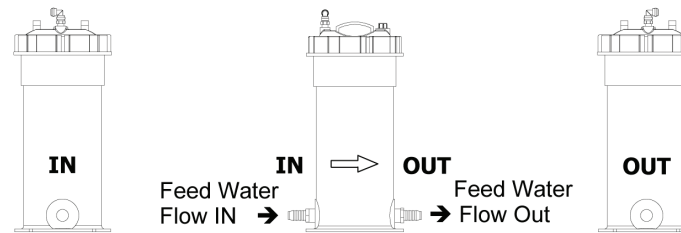
The controls within the System must be readily accessible for daily operation.

Ensure that all tubing and hose connections have sufficient space to be routed without kinks or sharp bends.

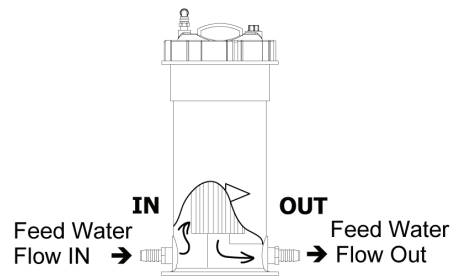
Keep the system within close proximity to the Pre-filtration Components and High Pressure Pump to ensure minimal line loss.

Figure 5b: Follow the labeling - NOT the molded arrows and lettering

COMMERCIAL PREFILTER CONNECTION AND WATER FLOW

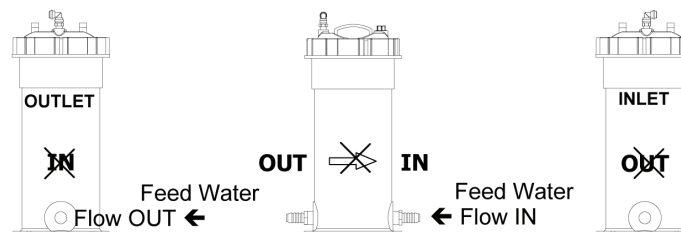


Commercial Prefilter is plumbed as per the raised arrows and markings IN and OUT

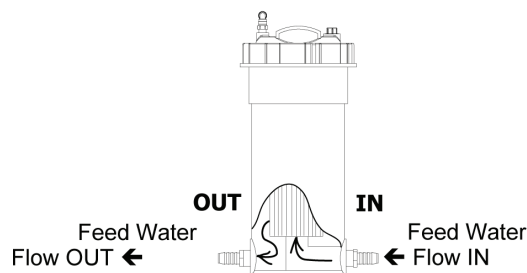


Feed Water Flow through the Commercial Prefilter Element is from the OUTSIDE of the Element to the INSIDE CENTER of the Element

OIL/WATER SEPARATOR CONNECTION AND WATER FLOW

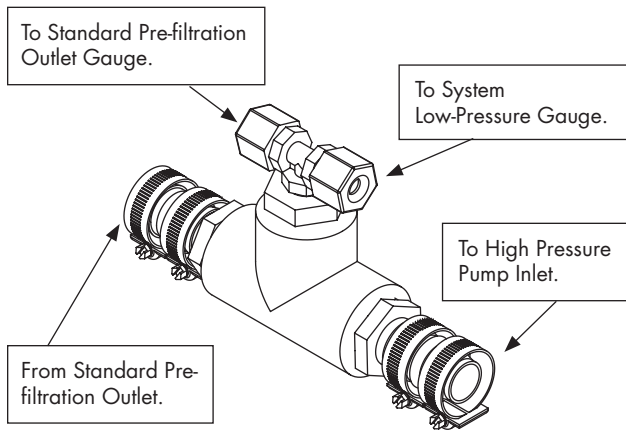


Oil/Water Separator utilizes the same housing as the Commercial Prefilter, however it is plumbed OPPOSITE of the Commercial Prefilter and OPPOSITE of the raised arrows and markings IN and OUT. Separate Labels are placed on the Oil/Water Separator indicating correct INLET and OUTLET.



Feed Water Flow through the Oil/Water Separator Element is from the INSIDE CENTER of the Element to the OUTSIDE of the element

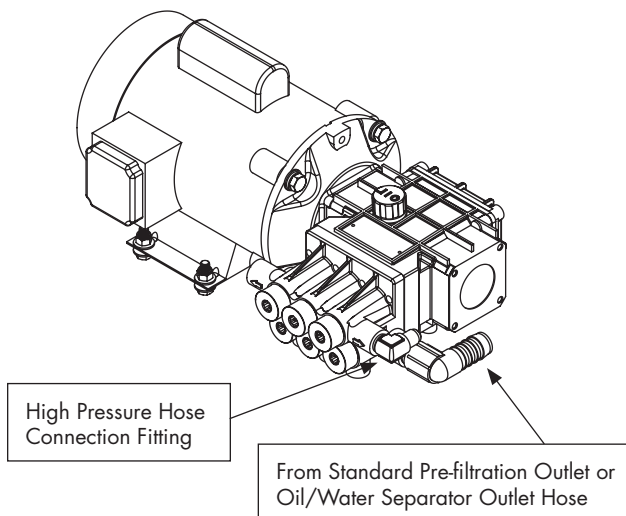
14. Low Pressure Pick Up Tee



The Low Pressure Pick Up Tee is supplied with the Standard Pre-filters. It installs in line with the hose leading from the outlet of the Standard Pre-filters to the inlet of the High-Pressure Pump. The ¼" Tube supplied is connected to both the Outlet Low Pressure Gauge on the Standard Pre-filters and High Pressure Pump Inlet Gauge on the Control Panel.

15. High Pressure Pump with Electric Motor Assy

[25 & 26] The Modular Style System High Pressure Pump and Motor Assembly require installation on a flat horizontal base.



Ensure easy access to pump crankcase oil changes and motor bearing grease fittings.

Use the supplied Rubber Isolation Mounts and hardware for mounting the Assembly.

Connect the Inlet of the High Pressure Pump to the Outlet of the Low Pressure Pick Up Tee.

16. R.O. Membrane/Vessel Assy [28 & 29]

Remove all Shipping Tube Plugs from the Membrane Vessel Assembly and from the side of the System.

Connect the Inlet High Pressure Hose from the Inlet of the R.O. Membrane Vessel Assembly to the High Pressure Pump outlet.

17. Future Reference

18. **3-Way Product Water Diversion Solenoid Valve [43]:** This valve is integrated in the control manifold assembly. It does not require individual installation.

19. Charcoal Filter [44]

Use the supplied mounting hardware to secure the filter to a flat vertical surface.

Leave a minimum 4" space below the bowl for removal of the Charcoal Filter Element.

Connect the Charcoal Filter Inlet to the product water outlet on the system manifold.

20. **U.V. Sterilizer [45]:** (optional) is the last Product Water component prior to the Product Water Storage Tank.

Mount the U.V. Sterilizer in a vertical position, with the Inlet port at the bottom and the Outlet at the top.

Horizontal mounting is also acceptable and either port may act as the Inlet or Outlet if mounted Horizontally.

The UV sterilizer should be mounted to a flat surface with the supplied two mounting saddles.

Using the supplied 3/8" O.D. tubing connect the Inlet (bottom if mounted vertically) to the Outlet of the Charcoal Filter.

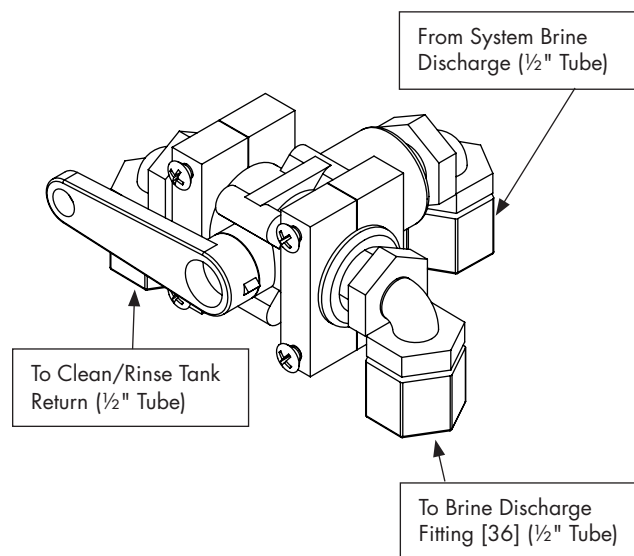
For detailed installation instructions, refer to section 4.5, Pg.4-18 - *UV Installation*

21. **Product Water Storage Tank Connector:** is a black 3/8" O.D. elbow tube fitting with 3/8" male pipe thread.

The easiest mounting method is to create a 3/8" female national pipe thread in the Ship's Product Water Storage Tank Fill Line or in the top of the tank itself. Using the supplied 3/8" tubing, connect the outlet of the Charcoal Filter to the connector.

If a U.V. Sterilizer is the final post-filtration component, connect the outlet of the U.V. to the product water storage tank connector.

22. **Brine Thru Hull Fitting** [37] must have a 1/2" MNPT nipple fitting inside the hull for connection of the Brine Discharge Tee [36]. It must be above Sea Level.
23. **Clean/Rinse Outlet Valve** [35]
This optional valve is used with the Inlet Clean/Rinse Valve #4 to assist in rinsing and cleaning of the System.



Install the Outlet Clean/Rinse Valve between the Brine Discharge and the Brine Discharge Tee Connector [36]. Using the Supplied 1/2 inch O.D. Tubing.

Connect one side port of the Outlet Clean/Rinse Valve to the Brine Discharge Tee Connector [36].

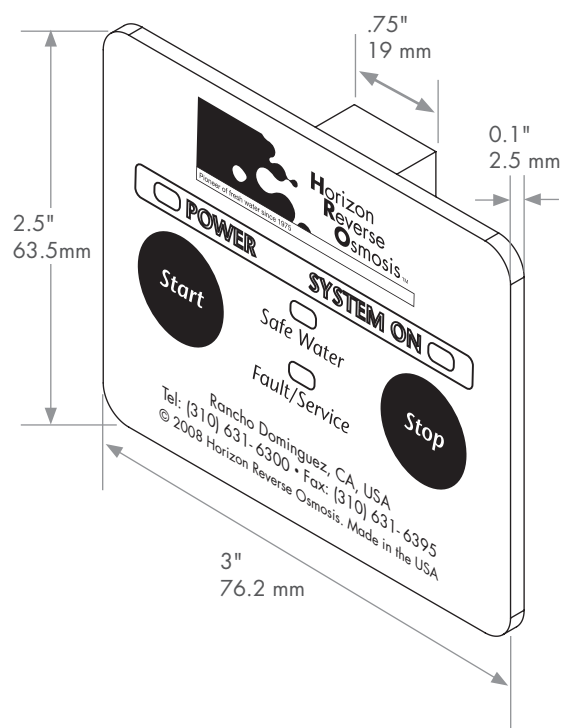
Connect the other side port to a Clean/Rinse Tank [50] Return or to a length of hose that can later be placed into a temporary Clean/Rinse Tank, Container or Bucket.

Connect the Center port to the Brine Discharge Tee Connector [36].

24. **Remote Control**
Often, the Remote Control Touch Pad is mounted in a recessed hole. After measuring the Remote Control Panel, routing out the indent and cutting the Cable hole, place the Touch Pad into the indent and check for sizing. Clean up the indent as required for a good fit. If the indent was made in wood or other porous surface then it is best to seal the surface of the indent so that the Touch Pad properly adheres to the indent surface. Once the indent hole has been sized and sealed

ensure that the indent is "squeaky clean" and free of dust so that the double stick tape attached to the Touch Pad properly adheres to the indent surface. Remove the green paper from the back of the Touch Pad to expose the double stick tape attached to the back of the Touch Pad. Position the Touch Pad directly over the Indent and press firmly into place for a permanent bond.

Remote Touch Pad Cut Out Dimensions for Mounting



25. **Electrical Connections** (also refer to Section 11 for electrical diagrams) Electrically connect, if not already connected, the following to the Horizon Seafari Controller:

- Optional U.V. Sterilizer
- Optional Fresh Water Flush Valve
- Optional Remote Unit
- Main Incoming Power
- Booster Pump Motor
- High Pressure Pump (Modular)
- High Pressure Pump Thermal (Modular) Low Pressure Switch
- Salinity Probe (Modular)
- Soft Motor Starter

4.5 UV STERILIZER INSTALLATION

The SP Series UV unit is shipped with the UV lamp, quartz sleeve, fittings, and O-rings and need to be assembled before the UV unit can be used.

1. Install the UV unit in a sheltered, well ventilated area.
2. Install the UV unit as close as possible to the point-of-use to avoid potential contamination discharge from pipes, fittings, etc.
3. The UV unit should be mounted on stable support to avoid straining or warping. Allow sufficient clearance around the unit for servicing.
4. Verify the location is free from vibration.
5. All UV units are rated for maximum operating pressure at 50 psig (8.24 bar).
6. The UV unit must be properly grounded for safe and proper operation. Failure to properly ground the UV unit automatically voids all unit warranty.
7. Line voltage must be within 10.56V to 16.50V. Voltage outside the range will compromise the performance of the UV unit.

Plumbing Requirements

All piping, tubes and hoses leading to the UV unit connection points must be leak-free before the UV unit can be installed.

NOTE! The UV unit may be installed horizontally or vertically. For vertical installation, make sure the inlet port is positioned at the bottom.

Installation Procedure

NOTE! Do not assemble or install damaged parts. Quartz sleeve and UV lamp are fragile and must be handled with care.

Install Fittings

Perform this procedure to prepare the UV unit for installation.

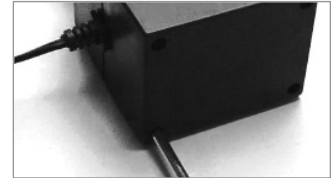
1. Inspect each port and fitting to ensure threads are free of dirt, burrs, and excessive nicks. If threads are badly nicked, replace the fitting.
2. Wrap ¼ inch (6.35 mm) wide PTFE tape 2 to 3 turns counter-clockwise around the male threads of the ¼ inch (6.35 mm) fitting.
DO NOT wrap tape around the first thread.

3. Screw the fitting into cylinder ports to finger tight position to achieve desired alignment.
4. Do not back-off fitting. Do not over-tighten fitting. Over-tightening could strip the fitting threads and cause a leak.

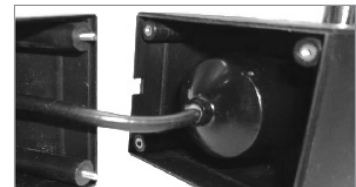
Install Quartz Sleeve

Perform this procedure only when water piping for UV unit is in place and ready for service.

1. Visually inspect quartz sleeve for cracks and damages.
2. Remove the ballast box cover. Remove the four screws holding the ballast box cover then remove the cover.



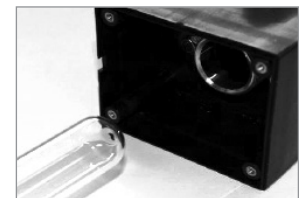
3. Remove the rubber boot. Pull out the 4-point lamp connector.



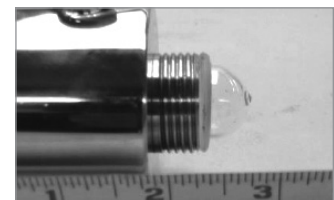
4. Remove the compression nuts.



5. Insert the quartz sleeve. Place the closed-end of the quartz sleeve into the cylinder through the ballast box pass-thru.



6. Leave a ½ in. (12.7 mm) of the quartz sleeve to expose on the viewport pass-thru.



7. Lubricate the tips of the quartz sleeve with clean water and insert new O-ring. Ensure the O-ring has all-round contact with the cylinder pass-thru.

8. Tighten the compression nut while making sure the nut does not contact the quartz sleeve. Adjust O-ring position as necessary. The compression nut should be snug and tight, not over-torque.
9. Repeat Step 7 and 8 on the ballast box compression nut.

Connect Plumbing

Tube or hose ends must be cut squared and clean; must have no rough edges. The quick fit elbow fitting has a C-clamp that will lock the tube in place once inserted.

1. Insert the supply pipe into one cylinder port and label the port "Inlet".
2. Insert the temporary pipe into the other cylinder port to direct water into a container.



3. Slowly fill the cylinder with water and flush cylinder for 1 minute.



4. Remove temporary pipe and insert the return pipe into the cylinder port and label the port "Outlet".
5. Slowly pressurize the UV unit by filling the cylinder with water while checking for leaks.
6. If leaks are found on the compression nuts, depressurize the unit and slightly tighten the leaking compression nut.
7. Retest until a leak-free installation is verified.
8. Once the UV unit is leak-free, the quartz sleeve installation is complete. The UV lamp can now be installed.



NOTE! To remove tube from fitting, first remove the C-clamp then push fitting sleeve down. Once the fitting sleeve is down, pull the tube out of the fitting.



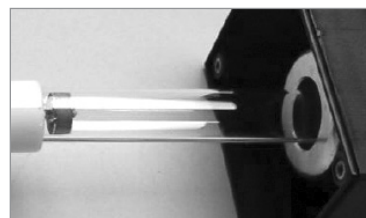
Install Ultraviolet Lamp

Perform this procedure only after the quartz sleeve installation and leak-tests are completed successfully

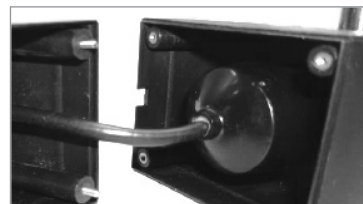
1. Connect the UV lamp to the 4-point receptacle. If the lamp is not installed properly, lamp breakage will occur.



2. Insert lamp into quartz sleeve through compression nut pass-thru.



3. Install rubber boot over compression nut.



4. Connect unit power cable to power source.
5. Tighten the 4 screws to secure ballast box cover.
6. Turn ON the power to the unit.
7. Verify UV lamp operation from the viewport.
8. Allow one minute for the UV lamp to warm up prior to flowing water through the UV unit.



CAUTION! Use the viewport to verify the proper operation of the UV lamp.



CAUTION! Rapid successive cycling of the power to the ballast can cause premature failure of the unit.

 **CAUTION!** Prior to energizing the lamp, make sure there is no water leaking from the quartz sleeve compression nuts.

Mounting the Unit

Once the UV unit is assembled and tested successfully, it can be mounted onto its permanent operational location. The unit must be mounted in a manner that will prevent excessive vibration and warping which will damage the quartz sleeve.

Operational Guidelines

- 4
- a) Release the pressure in the UV treatment chamber before breaking the compression nut seals.
 - b) Disconnect all power to the UV unit before servicing.
 - c) Do not allow the inlet water temperature to drop below 35°F (2°C).
 - d) Do not allow the flow rate to exceed 2 GPM (7.5 LPM).
 - e) Do not cycle the UV unit more than 3 “ON/OFF” cycles in a 24-hour period.
 - f) Ensure all plumbing connections are tightly sealed before applying pressure.
 - g) Before connecting the return tube, flush the unit to rinse out any debris left from the installation process.

 **WARNING!** UV light exposure can severely burn and damage eyes and skin

 **WARNING!** DO NOT look at the blue UV light. DO NOT operate the UV lamp outside of the UV treatment chamber.

 **CAUTION!** The unit operates on high voltage and must be serviced by qualified personnel only.

 **CAUTION!** Standard flow rate are based on water temperature 35°F to 100°F (2°C to 38°C) . If the inlet water temperature exceeds 100°F (38°C), please contact your local CSR.

 **CAUTION!** Cycling more than 3 cycles will reduce the end-of-life (EOL) output and/or cause premature lamp failure.

5

SYSTEM COMMISSIONING

Seafari Versatile 450 - 1800

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5 SYSTEM COMMISSIONING

Initial start-up procedure of a new HRO Systems Seafari Versatile.

Throughout this Manual, Numbers in [brackets] refer to the I.D. numbers illustrated on page 5 - 2.

The following instructions must be carried out for initial start-up of a NEW system. For every day use

starting procedures, refer to Section 6 "System Start-Up & Shut Down" of this manual.

Failure to follow these instructions exactly leads to system failure, and causes damage to the components. Read this section and other appropriate sections of the manual in order to gain familiarity with the requirements of the system and functions of each component.



AVOID CHEMICAL ATTACK TO THE SYSTEM

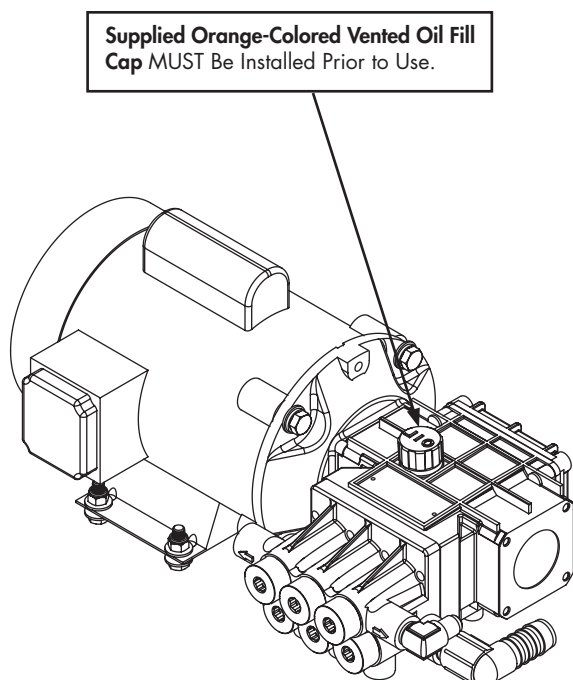
CAUTION: Do Not expose the Horizon Seafari system to intake Feed Water that contains:

- Hydrogen peroxide
- Chlorine dioxide
- Bromine
- petroleum products
- chloramines
- hypochlorite
- Bromide
- chloramines-T
- chlorine
- phenolic disinfectants
- N-chloroisocyanurates
- iodine

OR Any chemical, not approved in writing by HRO Systems.

USE OF NON-AUTHORIZED OR MISUSE OF AUTHORIZED CHEMICALS VOIDS SYSTEM

WARRANTY. DO NOT connect any water line to the Horizon Seafari system that may contain any of the above listed chemicals. **Example:** Do not connect the inlet of the Horizon Seafari system to the ships potable water system if the system contains chlorinated or brominated water. These chemicals destroy the copolymer components within the system. These oxidants and others also damage the R.O. Membrane Element.



5.1 HIGH PRESSURE PUMP PREPARATION

The high Pressure Pump is shipped with a red Non-Vented Plug so that oil does not leak during shipment.

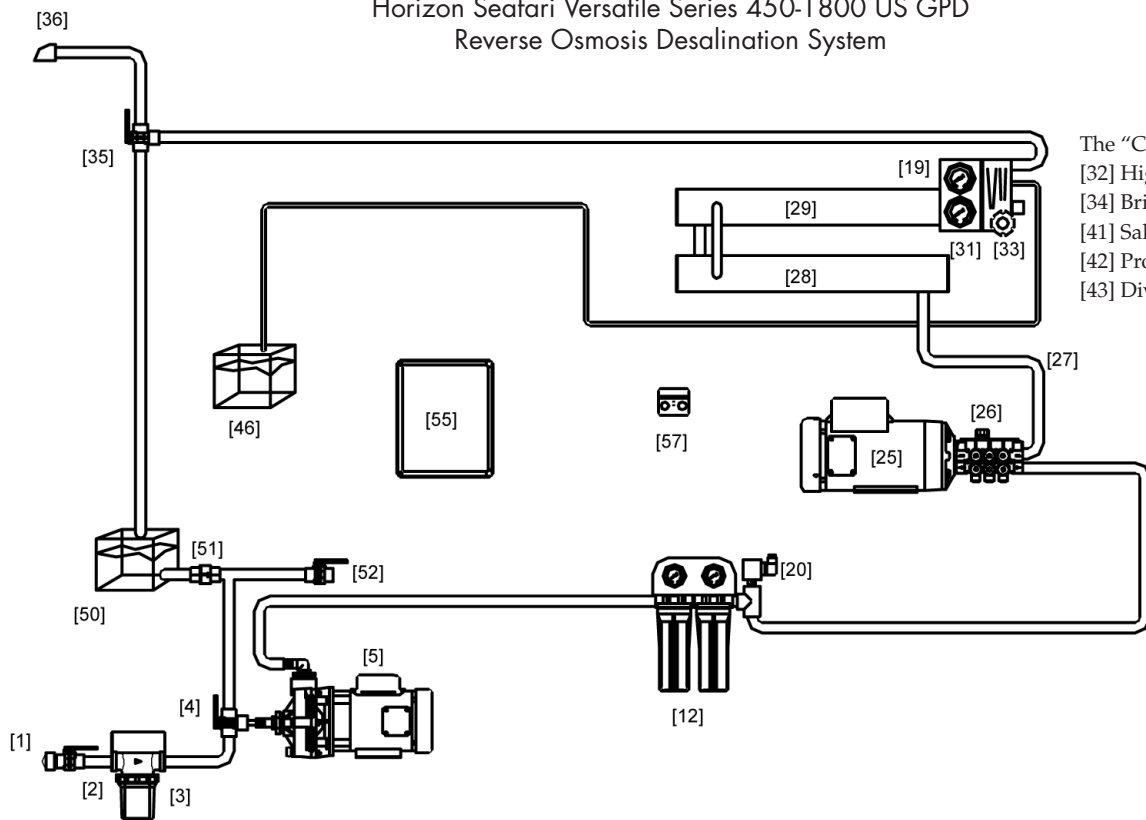
This red color Non-Vented Plug (located on the top of the black color rear crankcase section) must be replaced with the supplied Vented Oil Fill Cap.

If the crankcase is not vented with the proper cap, pressure builds within the crankcase and causes seal failure, loss of oil, and ultimately failure of the High Pressure Pump.

Failure to replace the shipping cap with the supplied Vented Oil Fill cap voids all Warranty of the High Pressure Pump. Installer will bear full responsibility for all damages resulting from failure to install the supplied High Pressure Pump Oil Fill Vented Cap.

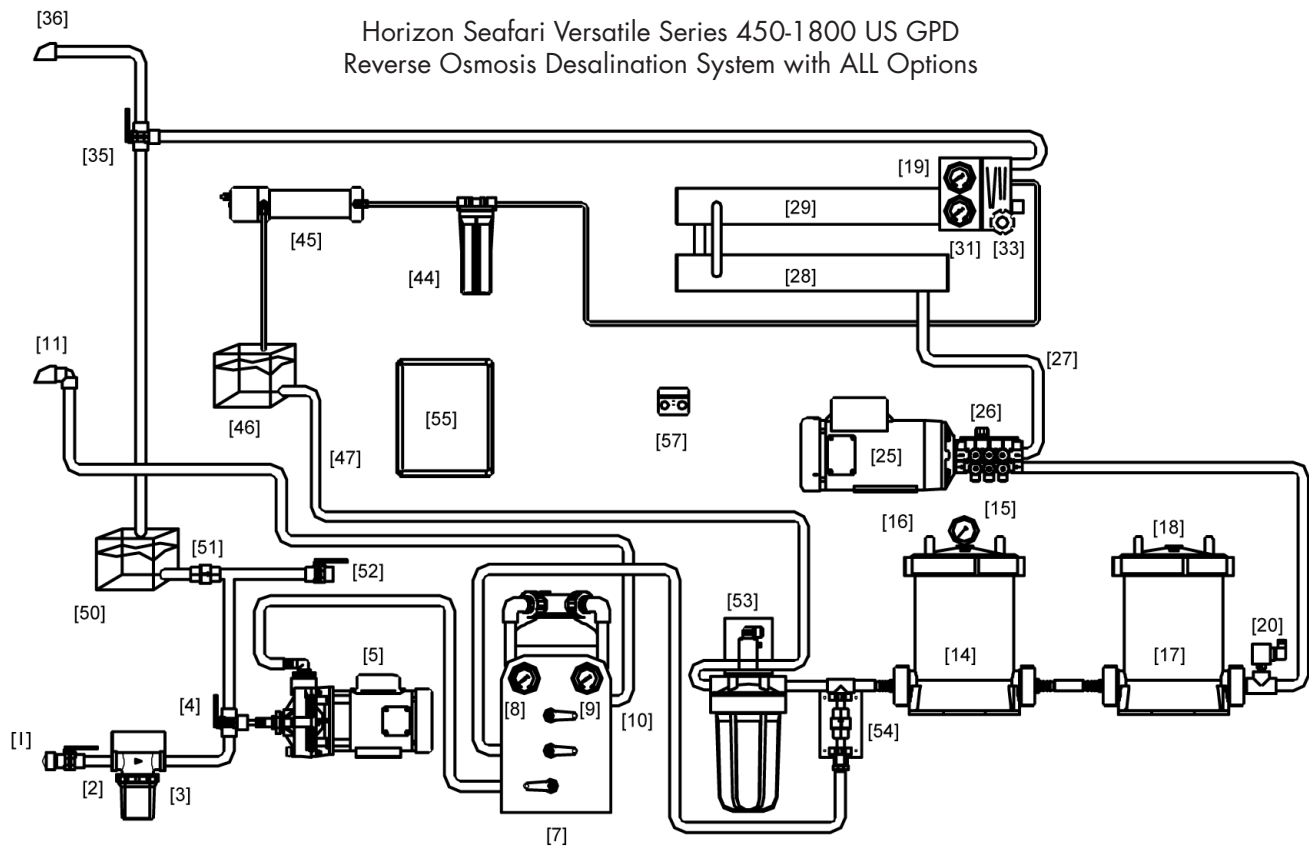
The "Cube" Contains:

- [32] High pressure Switch
- [34] Brine Flowmeter
- [41] Salinity Probe
- [42] Product Flowmeter
- [43] Diversion Valve



The "Cube" Contains:

- [32] High pressure Switch
- [34] Brine Flowmeter
- [41] Salinity Probe
- [42] Product Flowmeter
- [43] Diversion Valve



5.2 INITIAL START-UP PROCEDURE

1. Ensure that all Tube Plugs and shipping caps have been removed prior to commissioning. Failure to remove these caps could cause damage to the system.
2. Check the level of the oil in the High Pressure Pump crankcase. Ensure that the oil level is higher than the center of the sight glass.
Use only HRO supplied Pump Oil as it is special hydraulic oil, which contains anti rust and wear inhibitors essential to the high-pressure pump crankcase section.
3. Check each tube connection at the side panel of the System to ensure that the installer has properly connected and properly routed each tube. Improper routing and any blockage in any line causes damage to the system. Do not rely on the installers word, check it yourself.
4. Make sure that the Electrical Power Source to the System is switched "OFF".
5. Open the front panel of the Main Power Enclosure. Check all connections for proper wiring and attachment. Refer to the wiring diagrams in Section 11 and 13.
6. Close the Main Power Enclosure front panel.
7. Ensure that the manual By-Pass lever on the Diversion Valve [43] is positioned outward (away from the coil body). The manual bypass lever may be locked in the bypass position by pressing it in fully and then twisting 90° clockwise. To unlock, twist the button 90° counter-clockwise. See fig 5a below for location of the access hole to the Diversion Valve [43].

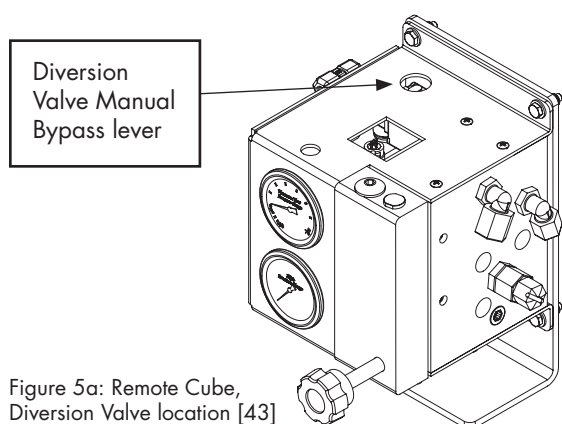


Figure 5a: Remote Cube, Diversion Valve location [43]

8. Close the Commercial Pre-filter [14] drain valve, if installed.

9. Close the Oil/Water Separator [17] Drain Valve, if installed.
10. Close the air bleed valve located on top of the Commercial Pre-filter [15], if installed.
11. Close the air bleed valve located on top of the Oil/Water Separator [17], if installed. Open the Inlet Sea Cock Valve [2] fully.
12. Position the Clean/Rinse Inlet Valve [4], if installed, to the normal operating position towards the Sea Strainer [3] Outlet.
13. Position the Clean/Rinse Outlet Valve [35], if installed, to the normal operating position towards the Brine Discharge Outlet [36].
14. Open any auxiliary Valve within the incoming Feed Line; Outgoing Brine Discharge Line; and Outgoing Product Water Line.



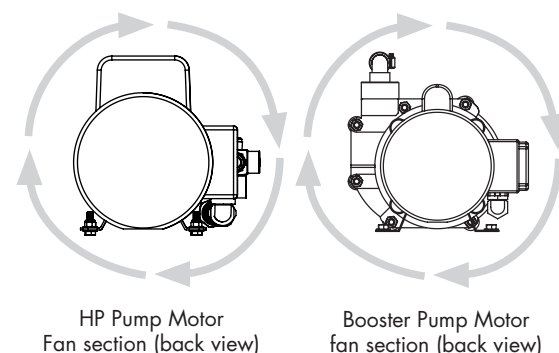
CAUTION: Any auxiliary Valve in these lines damages the Horizon Seafari if left closed during starting and or operation of the System.

15. Open the Back Pressure Regulator Valve [33] FULL OPEN by turning counter clockwise.



CAUTION: The Back Pressure Regulator Valve [33] must be full open when starting the Horizon Seafari System. If this valve is left closed, it may cause extensive damage to the system.

16. Switch the Electrical Power Source to the Salinity Controller "ON".
17. **Electric Motor Rotational Check**



Ask an assistant to view the fan section of the Electric Motors, (High Pressure Pump Electric Motor [25] and Booster Pump Electric Motor [5]) while you Jog the System.

Press the “Booster Pump” switch, then the “Start” switch, and finally the “Stop” switch. Ensure that the High Pressure Pump Electric Motor and the Booster Pump Electric Motor turned in the proper rotation. If either or both motors turned in the wrong direction refer to the wiring diagrams in Section 11 to correct.

18. Multi Media Filter Preparation

The Multi Media Filter should be loaded with gravel and #20 silica sand. When new, the media must be back washed then rinsed prior to use. These procedures fluff and clean the silica sand base. During back washing the suspended solids are discharged. Follow the Backwashing Instructions on Page 9 – 5.

When Backwashing is complete, make sure to position the Multi Media Filter Valves for Normal Operation.

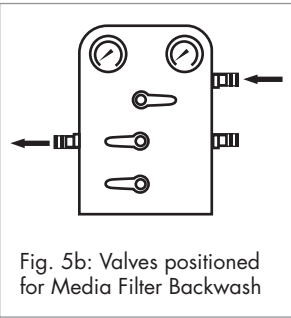


Fig. 5b: Valves positioned for Media Filter Backwash

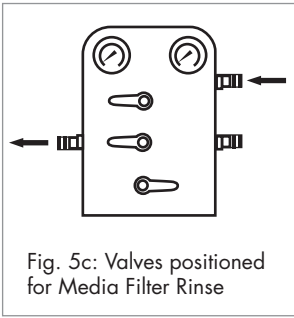


Fig. 5c: Valves positioned for Media Filter Rinse

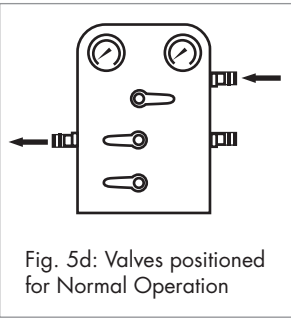


Fig. 5d: Valves positioned for Normal Operation

19. To start the system press the “Start” Switch, or press the “Booster Pump” Switch and then the “Start” switch.

If the system automatically shuts off after several seconds of operation this may be due to a system fault. Look at the Touch Pad to confirm whether a fault has occurred.

20. Bleed all air from the Commercial Pre-filter [14] and Oil/Water Separator [17] by opening the air bleed valve located at the top of the each housing [16 & 18] and close when water displaces all of the air.

21. Slowly adjust the Back Pressure Regulator Valve [33] by turning clockwise to increase the pressure to the proper setting (850 psi for 35,000 ppm seawater).

For BRACKISH WATER operation, adjust the pressure from 100 to 850 psi so the product water output, is within the system specifications.

Hourly Production:

Model	Gal	Lit
Horizon Seafari 400-1	18	70
Horizon Seafari 700-1	26	110
Horizon Seafari 900 / 900-2	38	140
Horizon Seafari 1400-2	58	220
Horizon Seafari 1800-2	75	285

CAUTION: Do not exceed product water flow specifications.

22. If any abnormality develops, stop the System and correct the problem.
23. Use the Product Water Flow Meter [42] to measure the product flow. The system may not produce “potable” water for up to 30 minutes. The salinity of the Product Water diminishes gradually, until it reaches the factory setting at which time it is directed to the “potable” (good water) position. This allows product water to pass into the Post Filtration components, and onto the Ship’s Storage Tank [46].
16. Check for:
- a. A constant feed water flow.
 - b. A consistent system pressure.
 - c. Leaks in the system.
 - d. Unusual noises or other occurrences.

**NOTICE TO COMMISSIONING OPERATOR**

The person commissioning the New Horizon Seafari system should, at this time, fill out the two INITIAL SYSTEM READINGS forms located on Pages 5-7 and 5-9.

Retain in this Manual the form on page 5-6 for the owner and future operator's reference. This information is valuable to the servicing technicians in providing technical support to the owner and future operators of the Horizon Seafari system.

The person or company who performed the commissioning of the New Horizon Seafari system should retain the form on page 5-8. This information is valuable to the servicing technicians in providing technical support to the owner and future operators of the Horizon Seafari system.

Horizon Seafari NEW SYSTEM INITIAL READINGS**- KEEP THIS COPY IN THE OWNER'S MANUAL -**

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Record at the time of initial system commissioning the following after one hour continuous proper running of the system. Maintain this original form with the System Owner's Manual for future reference and troubleshooting.

Serial Number: _____ Model No: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ ° Fahrenheit, or _____ Centigrade

Hour Meter Reading: _____ Hours

PRESSURE GAUGE READINGS:

Commercial Pre-filter (if used) Low Pressure Gauge Reading: _____ psi

Control Panel Low Pressure Gauge Reading: _____ psi

High Pressure Gauge reading: _____ psi

WATER FLOW METER READINGS:

Brine Flow Meter _____ US gpm or _____ Liters Per Min.

Product Water Flow Meter: _____ US gph or _____ Liters Per Hr.

WATER QUALITY:

Feed Water Salinity: _____ ppm or Location of use _____

Product Water Salinity: _____ ppm

Unusual occurrences: _____

Horizon Seafari NEW SYSTEM INITIAL READINGS

- THIS COPY IS FOR THE INSTALLER, DEALER, OR COMMISSIONER. -

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Record at the time of initial system commissioning the following after one hour continuous proper running of the system. Maintain this original form with the System Owner's Manual for future reference and troubleshooting.

Serial Number: _____ Model No: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ ° Fahrenheit, or _____ Centigrade

Hour Meter Reading: _____ Hours

5

PRESSURE GAUGE READINGS:

Commercial Pre-filter (if used) Low Pressure Gauge Reading: _____ psi

Control Panel Low Pressure Gauge Reading: _____ psi

High Pressure Gauge reading: _____ psi

WATER FLOW METER READINGS:

Brine Flow Meter _____ US gpm or _____ Liters Per Min.

Product Water Flow Meter: _____ US gph or _____ Liters Per Hr.

WATER QUALITY:

Feed Water Salinity: _____ ppm or Location of use _____

Product Water Salinity: _____ ppm

Unusual occurrences: _____

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6

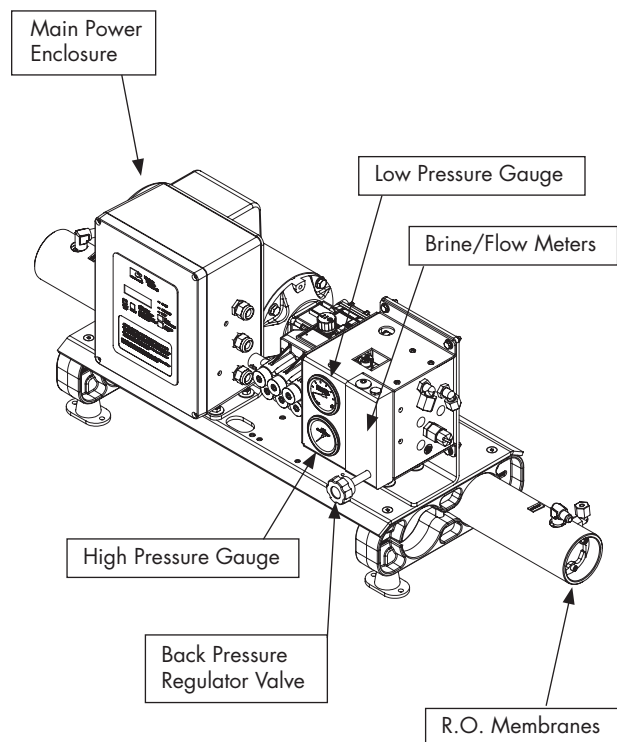
SYSTEM START UP & SHUT DOWN

Seafari Versatile 450 - 1800

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6 SYSTEM START UP & SHUTDOWN

6.1 START UP PROCEDURE



1. Check the level of the oil in the High Pressure Pump crankcase. Ensure that the oil level is higher than the center of the sight glass.
2. Open the Inlet Sea Cock Valve [2] fully.
3. Position the Clean/Rinse Inlet Valve [4], if installed, to the normal operating position.
4. Position the Clean/Rinse Outlet Valve [35], if installed, to the normal operating position.
5. Open any auxiliary Valve within the incoming Feed Line.
6. Open any auxiliary Valve in the Outgoing Brine Discharge Line.
7. Open any auxiliary Valve in the Outgoing Product Water Line.
8. Set the Multi Media Filter Valves, if installed, for the Normal Operating Position.
9. Fully Open the Back Pressure Regulator Valve [33].
10. Switch the Electrical Power Source to the Salinity Controller [56] "ON".
11. To start the system press the "Start" switch, or

press the "Booster Pump" switch and then the "Start" switch.

If the System automatically shuts off after several seconds of operation, look at the Touch Pad to determine whether a fault has occurred. If so, correct fault and repeat Step 11. For fault explanation, see following page.

12. Bleed all air from the Commercial Pre-filter [14] and Oil/Water Separator [17] by opening the air bleed valve located at the top of the each housing [15 & 18] and close when water displaces all of the air.
13. Slowly adjust the Back Pressure Regulator Valve [33] by turning clockwise to increase the pressure up to the proper setting (850 psi for 35,000 ppm seawater).

For BRACKISH WATER operation, adjust the pressure from 100 PSI to 850 so the product water output, is within system specifications.

Hourly Production:

Model	Gal	Lit
Horizon Seafari 400-1	18	70
Horizon Seafari 700-1	26	110
Horizon Seafari 900 / 900-2	38	140
Horizon Seafari 1400-2	58	220
Horizon Seafari 1800-2	75	285

CAUTION: Do not exceed product water flow specifications.

14. If any abnormality develops, stop the System and correct the problem.
15. Use the Product Water Flow Meter [42] to measure the product flow. The salinity of the Product Water diminishes gradually, until the product water reaches the factory setting at which time the product water passes into the Post Filtration components, and onto the Ship's Storage Tank [46].
16. Check for unusual noises or other occurrences.

6.1.1 SOFT START OPERATION

The Horizon Seafari system may have a Soft Start installed. This Soft Start reduces the current (amps) required at startup for single-phase systems. This is accomplished by reducing the startup torque of the motor. There are a few things one should know when operating a system equipped with a

motor Soft Start.

Never start the system without the Back Pressure Regulator Valve [33] open fully. The reduced torque available to the motor is not sufficient to turn the high-pressure pump when the Back Pressure Regulator Valve is adjusted to 850 psi. Starting while the Back Pressure Regulator is not fully open causes damage to the motor.

The Start Sequence for a system equipped with a Soft Motor Starter is as follows:

1. When the "Start" switch is pressed, power is present at the Soft Start.
2. The Soft Start immediately begins its starting cycle.
3. After a few seconds, the motor reaches full speed and the High Pressure Pump contactor makes an audible click and is switched on.

The Soft Motor Starter has a 30 Amp circuit breaker on its enclosure. When the circuit breaker trips, the Soft Starter power does not ramp properly. Check the motor wiring and Soft Start to spot any wiring problems. Reset the breaker inside the controller before repeating the start sequence. If the circuit breaker interrupts power repeatedly, the system may require service.

6

The Soft Starter is equipped with a temperature sensor. The temperature sensor is designed to stop operation when the Soft Start overheats. Before restarting the system, the main power must be disconnected to reset the Soft Start's logic. Overheating occurs when the system is exposed to extreme heat or it is started and stopped repeatedly over a brief span of time.

Fig 6a: The System Illustrated in the 3 separate stages of Start Up Operation. The System is shown with Rinse/Clean Valves and Plankton Filter Optional Equipment.

In operation without pressure applied to the R.O. Membrane Elements.

Fig. 6a: Horizon Seafari Versatile Series 450-1800 US GPD Reverse Osmosis Desalination System
Shown during first 5 minutes of operation without pressure applied

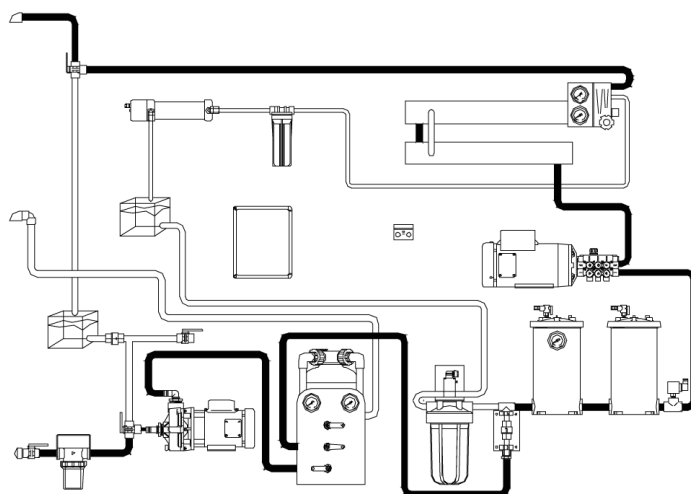


Fig. 6b: In operation with pressure applied to the R.O. Membrane Elements. Product Water is being produced, however the Product Water is not yet Potable.

Fig. 6b: Horizon Seafari Versatile Series 450-1800 US GPD Reverse Osmosis Desalination System
Shown with pressure applied but product water is not yet potable

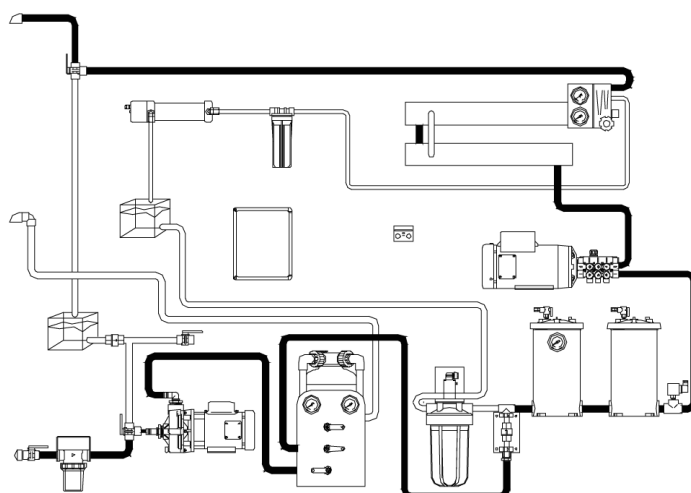
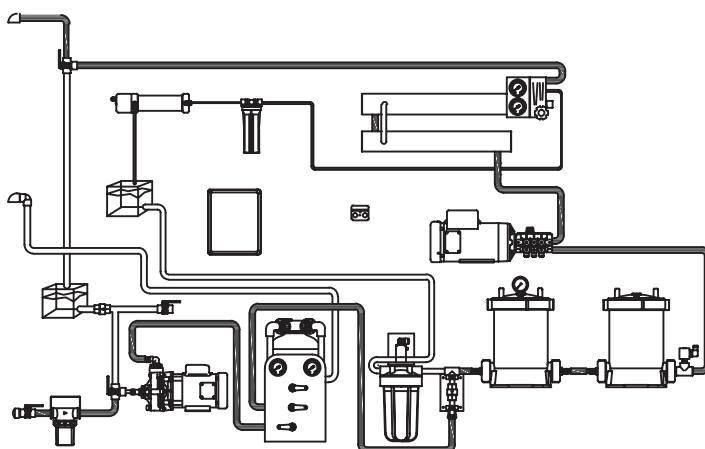


Fig. 6c: In operation with pressure applied to the R.O. Membrane Elements and the Product Water that is being produced is Potable.

Fig. 6c: Horizon Seafari Versatile Series 450-1800 US GPD Reverse Osmosis Desalination System
Shown pressurized and producing potable water



6.2 SHUT DOWN PROCEDURE

6.2.1 SHUTDOWN CAUTIONS



Prior to system shutdown, it is strongly recommended that the operator observe and compare the performance of the Horizon Seafari system with the normal operation specifications listed in Section 2.3 and Initial New System Readings from Section 5, pg. 5-6 / 5-7 of this manual.

By checking the system performance prior to shutdown, any deviations from normal operation are identified and corrected prior to the next use of the system. This ensures a properly functioning system when it's needed. If an observed problem is easily defined as a minor one, which does not affect other system components, wait until the product water storage tank(s) is (are) full before shutdown.



CAUTION: High Temperature Condition
The Pre-filtration Subsystem, High Pressure Pump and/or R.O. Membrane Elements may have been mounted in a location that is subject to excessive heat. As an example, overheating may occur when the components are mounted in a vessel's engine compartment, or in an unventilated building. The transfer of atmospheric heat could raise the standing water temperature in the components above 122° F/50 C. At or above this high temperature, pressurized hot water could cause irreversible damage to the HRO R.O. Membrane Elements. Therefore, the Back Pressure Regulator Valve [33] must be opened at the time of shutdown. This ensures that, at the next start-up, new water may enter and cool the system while it is un-pressurized.

6.2.2 SHUTDOWN SEQUENCE

1. Open the Back Pressure Regulator Valve [33] fully.
2. Momentarily depress the "Stop" switch on the System's front panel Touch Pad.

Check to make sure that both the Booster Pump and the High Pressure Pump have stopped rotating.
3. Close the Inlet Sea Cock Valve [2]. This is a safeguard for vessel installations.
4. If installed, the Fresh Water Flush (FWF) system is initiated when the "Stop" switch is pressed. The fresh water flush lasts for 10 minutes. After 10 minutes, the fresh water flush stops but remains in FWF mode. In this mode, the fresh water flush repeats the ten-minute rinse every 7 days. To continue the 7-day cycle, do not proceed to Step 5.
5. Press the "Stop" switch to cancel the Fresh Water Flush mode.
6. Turn off the electrical power source (circuit breaker) to the system. This eliminates the chance of inadvertently starting the system.
7. Refer to Section 8, "Storage & Cleaning Procedure" in this manual.

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Horizon Seafari DAILY OPERATIONAL LOG RECORD

KEEP THIS COPY IN THE OWNER'S MANUAL UNTOUCHED AS A MASTER FOR ADDITIONAL COPIES

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Serial Number: _____ Model No: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ ° Fahrenheit, or _____ Centigrade

Hour Meter Reading: _____ Hours

PRESSURE GAUGE READINGS:

Commercial Pre-filter (if used) Low Pressure Gauge Reading: _____ psi

Control Panel Low Pressure Gauge Reading: _____ psi

High Pressure Gauge reading: _____ psi

WATER FLOW METER READINGS:

Brine Flow Meter _____ US gpm or _____ Liters Per Min.

Product Water Flow Meter: _____ US gph or _____ Liters Per Hr.

WATER QUALITY:

Feed Water Salinity: _____ ppm or Location of use _____

Product Water Salinity: _____ ppm

Unusual occurrences: _____

Horizon Seafari DAILY OPERATIONAL LOG RECORD

KEEP THIS COPY IN THE OWNER'S MANUAL UNTOUCHED AS A MASTER FOR ADDITIONAL COPIES

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Record at the time of initial system commissioning the following after one hour continuous proper running of the system. Maintain this original form with the System Owner's Manual for future reference and troubleshooting.

Serial Number: _____ Model No: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ ° Fahrenheit, or _____ Centigrade

Hour Meter Reading: _____ Hours

PRESSURE GAUGE READINGS:

Commercial Pre-filter (if used) Low Pressure Gauge Reading: _____ psi

Control Panel Low Pressure Gauge Reading: _____ psi

High Pressure Gauge reading: _____ psi

WATER FLOW METER READINGS:

Brine Flow Meter _____ US gpm or _____ Liters Per Min.

Product Water Flow Meter: _____ US gph or _____ Liters Per Hr.

WATER QUALITY:

Feed Water Salinity: _____ ppm or Location of use _____

Product Water Salinity: _____ ppm

Unusual occurrences: _____

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7

SYSTEM TROUBLESHOOTING GUIDE

Seafari Versatile 450 - 1800

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7 TROUBLESHOOTING

Some system problems have possible causes located in more than one subsystem, and are categorized here according to the subsystem in which they are indicated or most likely to be located. Where two or more possible causes are listed for a problem, it is advised that they be checked in the order listed. This Troubleshooting Guide lists the abnormal symptom and its possible cause. In order to correct the problem or repair the part, refer to the Maintenance and Repair Section 9 of this manual.

1) System shuts down by itself and a fault lamp is illuminated:

View the Touch Pad Fault Indication Lamps.

- a) If the High/Low Pressure Fault Lamp is Illuminated:

NOTE: This indicator may illuminate due to either a Low Pressure Fault or due to a High Pressure Fault. The two causes are examined below.

Low pressure causes: The High/Low Pressure Fault Lamp illuminates when the Low Pressure Switch is OPEN and after 10 seconds of illumination the System shuts off.

Solution: Press the Fault Reset Switch then Start the System. Take note of the Low Pressure Gauge reading at the control panel.

- If the Low Pressure Gauge does not move from zero this indicates that there is air entering the System intake line.

Solution: Correct any air suction leaks.

- If the Low Pressure Gauge needle moves and registers below 6 psi or draws a vacuum this indicates one or more dirty Pre-filtration components.

Solution:

- Open the Inlet Seacock Valve
- Clean the Sea Strainer Mesh Screen
- Back Wash the Multi Media Filter
- Clean the Plankton Mesh Screen
- Change the Pre-filter Element(s)
- Change the Oil/Water Separator Element



NOTE: After the last shutdown and after the system has sat for some time, the debris clogging the particular filter element becomes loose and settles to the bottom of the filter bowl. There may be sufficient pressure at the Low Pressure Gauge immediately after starting the system, but within 30 to 60 minutes the system shuts down again because debris is stirred up and clogs the filter element.

High Pressure Causes: This may be due to pressurizing the System above 950 psi. The High/Low Pressure Fault Lamp illuminates immediately when the High Pressure Switch is OPEN and the system shuts off immediately.

Solution: Follow the Brine Discharge Line and ensure that there is no kink or blockage in this line. Ensure that any Valve in the Brine Discharge Line is fully OPEN.

Follow the Product Water Line and ensure that there is no kink or blockage in this line. Ensure that any Valve in the Product Water Line is fully OPEN.

Open the Back Pressure Regulator Valve fully.

Press the Fault Reset Switch then Start the System. The High Pressure Gauge reading at the control panel should be below 50 psi at this time.

Adjust the Back Pressure Regulator as explained in the Start Up Procedure in Section 6 of this manual.

2) System shuts down by itself and a fault lamp is not illuminated:

If the system shut down but a Fault Lamp is not illuminated, then the cause would be electrical.

Power loss caused the system to shut down.

The Power Source Circuit Breaker feeding the system has tripped and requires resetting, or it is weak and not passing full voltage, or it is rated too low for the full load amperage of the system.

Solution: Reset the Circuit Breaker and check the circuit breaker to ensure that it passes full voltage across all legs when the system is fully pressurized.

Ensure that the Circuit Breaker is of the proper amperage rating for the System.

The Line Power had a temporary drop out or

voltage fluctuation caused by other auxiliary equipment pulling current exceeding the permissible load on the Power Source.

There is a loose wire from the Power Source to the System or within the System Electronic Controller, which is intermittently opening the power to the System.

3) Vacuum / Low pressure gauge readings:

The System is equipped with one or more Low Pressure Gauges depending upon which Pre-filtration equipment is installed. Always correlate each of these Low Pressure Gauges to determine which Pre-filtration component is dirty and requires maintenance. The inlet pressure minus the outlet pressure of any component is known as the differential pressure.

Solution: The pressure gauges used through the System contain a small orifice at the pressure port stem. This orifice can become plugged up with debris or corrosion. If the gauge fails to register then clean the pressure pick up orifice with a thin stiff wire or small drill bit. Use caution when inserting the cleaning wire or drill bit into the orifice.

4) High Pressure Gauge Reading:

Use caution in diagnosing the reading of the High Pressure Gauge. If the gauge is reading low it may simply be that the Back Pressure Regulator requires adjustment. However, there may be a problem with the High Pressure Pump or the High Pressure Pump Electric Motor, Back Pressure Regulator Valve, the High Pressure Gauge, or the R.O. Membrane. A high, full load, amperage draw at the High Pressure Pump Electric Motor indicates that the High Pressure Pump is applying pressure within the System.

- a) High Pressure Gauge reading is low with normal Brine Discharge Flow Meter reading and low or no product water flow meter reading:

Solution: Back Pressure Regulator requires adjustment to normal System operating pressure.

- b) High Pressure Gauge reading is low with normal Brine Discharge Flow Meter reading and normal product water flow meter reading:

Solution: Dirty orifice in the High Pressure Gauge pressure port requires cleaning.

- c) High Pressure Gauge reading is low, Brine Discharge Flow Meter reading is low, and

Product Water Flow Meter reading is either normal or low:

- High Pressure Pump has a problem within the manifold
- Worn Seals are allowing internal bypassing
- Broken or stuck valve or valve spring or debris in the valve chamber is allowing internal bypassing

- d) Product water flow meter registers flow and the Salinity Meter Red LED is illuminated:

R.O. Membrane Vessel Assembly is bypassing Feed Water into the Product Water.

The R.O. Membrane Element has a cracked product water tube.

Solution: A cracked product water tube is caused by a blockage in the Product Water line. Ensure that there are no blockages, valves or kinks in this line.

The End Cap Product Water O-Ring is cut or worn.

Solution: A worn product water O-Ring allows Feed Water to enter the Product Water.

5) Flow Meter Readings:

In diagnosing flow meter readings always correlate the reading with both the Brine Discharge Flow Meter reading and the Product Water Flow Meter reading. Consider the Pressure Gauge readings as well. Prior to diagnosing flow meter readings, always check first to ensure that the pressure gauge readings are normal. The symptoms and causes listed below assume that all pressure gauge readings are normal.

- a) Brine Discharge Water Flow Meter: At zero system pressure, the Brine Discharge Flow Meter registers the Feed Water flow through the system. With High Pressure applied, the Brine Discharge Flow Meter registers the Brine discharge flow, which is feed flow minus the product water being produced.

The High Pressure Pump is a positive displacement pump. It pumps a fixed amount of water unless there is a problem with the High Pressure Pump itself. Therefore, a drop from normal reading on the Brine Discharge Flow Meter indicates the High Pressure Pump is not functioning properly.

Brine Discharge Water Flow Meter reading is less than normal and the Product Water Flow Meter registers flow even with no operating pressure applied to the system:

R.O. Membrane Vessel Assembly is allowing bypassing of Feed Water into the Product Water.

The R.O. Membrane Element has a cracked product water tube.

Solution: A cracked or broken product water tube is caused by a blockage in the Product Water line. Ensure that there are no blockages, valves or kinks in this line.

The End Cap Product Water O-Ring is cut or worn which allows Feed Water to enter into the Product Water.

Brine Discharge Water Flow Meter reading is normal with no pressure applied to the system but as pressure is increased, the Brine Discharge Water Flow Meter drops below normal flow.

High Pressure Pump has a problem within the manifold

Worn Seals are allowing internal bypassing

Broken or stuck valve or valve spring or debris in the valve chamber is allowing internal bypassing

Brine Discharge Water Flow Meter reading is normal with no pressure applied, but the bobbin is pulsating up and down and as pressure is applied the pulsation increases.

High Pressure Pump has a broken or stuck valve or valve spring, or debris in one of the discharge valve chambers, which is causing a valve to not properly seat.

- b) Product Water Flow Meter: The Product Water Flow Meter registers the amount of Product Water being produced by the R.O. Membrane Element. In Sea Water applications the Product Water Flow Meter does not register until the System Pressure exceeds 420 PSI. Therefore, if full production registers on the Product Water Flow Meter at or below 420 PSI operating pressure, in full salinity seawater, this indicates that the R.O. Membrane Vessel Assembly has a problem, such as a defective O-Ring, defective Membrane Element, broken product water tube, cracked end plug or damaged High Pressure Vessel.

If the operating pressure of 850 psi produces a Product Flow Meter reading below normal this indicates one or more of the following causes:

- The system Feed Water is at a low temperature
- The salinity of the Feed Water is greater than 35,000 ppm (typical Sea Water);
- The R.O. Membrane Element is fouled and requires cleaning;
- The R.O. Membrane Element has dried out and requires replacement
- The R.O. Membrane Element has been subjected to chemical fouling and requires replacement
- The R.O. Membrane Element has been exposed to temperatures above 140° F and requires replacement;
- The R.O. Membrane Element has been subjected to pressures above 1000 PSI, has been compacted and requires replacement.

Product Water Flow Meter registers substantial flow when the system operating pressure is below 420 PSI and the system is operating in full salinity seawater:

The R.O. Membrane Element has a cracked product water tube.

A cracked or broken product water tube is caused by a blockage in the Product Water line. Ensure that there are no blockages, valves or kinks in this line.

The End Cap Product Water O-Ring is cut or worn.

A worn product water O-Ring allows Feed Water to enter into the Product Water.

After compensating for Temperature of the Feed Water, the Product Water Flow Meter registers lower than normal flow when the system operating pressure is 850 PSI and the system is operating in seawater:

Membrane Element is fouled or has been damaged and requires cleaning or replacement.

There is a restriction in the Product Water Line.

Temperature and Pressure correction

has not been properly calculated. Refer to Section 12.

High Pressure Gauge is defective and registering higher than the actual applied pressure.

6) Product water quantity and quality:

The R.O. Membrane Element requires a specified amount of Feed Water flow in order to reject impurities. Less than required Feed Water flow causes the R.O. Membrane Element to recover a high percentage of Product Water (ratio of Feed Water to Product Water) and causes the R.O. Membrane Element to foul quickly. It is, therefore, important to maintain the Feed Water Flow into the R.O. Membrane Element to prevent mineral build up fouling. If the High Pressure Pump is damaged, do not operate the system until the Feed Flow problem is corrected.

The clarity of the Feed Water affects the R.O. Membrane Element performance. If the Pre-filtration Section is not trapping the suspended solids, the R.O. Membrane Element quickly becomes fouled. Always ensure that there are clean Pre-filter Elements and change them frequently.

Always use genuine HRO Pre-filter Elements as they last longer and are FDA approved. Non HRO Pre-filter Elements are less efficient causing more frequent changing. This may lead to neglect and fouling of the R.O. Membrane Element.

Sea Water (35,000 ppm TDS) applications operate at 850 PSI to gain optimal performance. Pressures below 850 PSI cause low Product Water Production and poor Product Water Quality. The Operating Pressure is correlated to the Feed Water Temperature, production rate, and Feed salinity.

When operating from typical 35,000 ppm TDS Sea Water and a Feed Water Temperature below 77°F / 25 C, the system may be operated at higher pressures not to exceed 1000 psi, in order to gain optimal performance. With a Feed Water Temperature above 77° F / 25 C, the system must be operated at lower pressures in order to prevent excessive Product Water recovery and fouling. There is a decline in Product Water Quality with Feed Water Temperatures above 77° F / 25 C. This is natural and expected with the Reverse Osmosis process, and does not indicate a problem.

- a) Water Quality is higher than normal or the red light does not go out.

The system pressure is below normal. Adjust it accordingly.

The Feed Water Temperature is above 77° F / 25 C

The Feed Water Salinity is above 35,000 ppm TDS due to operation in a high salinity sea

- b) The Brine Discharge Water Flow Meter is reading lower than normal.

Refer to the Brine Discharge Water Flow Meter troubleshooting.

A product water "O" ring within the R.O. Membrane Element Vessel requires replacement.

The R.O. Membrane Element has developed a hole or cracked product water tube. (This also causes higher product water flow, and high product water salinity.)

7) High Pressure Pump:

The high-pressure pump is a positive displacement triplex plunger pump. The pump always delivers the normal amount of water flow unless a problem develops within the pump, the pump is being subjected to an extreme vacuum at its inlet, or the RPM from the Electric Motor has changed due to low or high Cycles from the Power Source.

High Pressure Pump flow is normal when the system operating pressure is at zero, but the flow drops below normal as pressure is applied: Keep in mind that the Brine Discharge Flow Meter registers full feed water flow when there is no pressure applied to the system and as pressure is applied to the system the Brine Discharge Flow Meter drops in relationship to the amount of product water that is then being produced. Therefore, as pressure is applied to the system this Brine Discharge Flow Meter drops in predictable flow registration by design. That would not indicate a problem. However, if flow drops beyond the normal decrease then:

- Worn High Pressure Pump seals are allowing internal bypassing and require replacement.
- Worn High Pressure Pump valves, valve seats, valve springs and or valve seat "O" rings are allowing internal by-passing and require replacement.
- Worn, corroded or eroded manifold is

allowing internal by-passing and requires replacement.

- There is debris in the valve chamber(s) causing one or more valve to remain open.
- The Electric Motor RPM is low due to improper Cycles from the Power Source to the System.

High Pressure Pump flow is normal (at the Brine Discharge Flow Meter) when the system operating pressure is at zero, but the flow becomes erratic and pulsating as pressure to the system is applied:

- Worn or broken High Pressure Pump Discharge Valves, Discharge Valve seats, Discharge Valve springs and or debris is trapped within a High Pressure Pump Discharge Valve chamber.

High Pressure Pump flow is erratic and worsens with increased system pressure:

- Worn or broken High Pressure Pump Inlet Valves, Inlet Valve seats, Inlet Valve springs and or debris is trapped within a High Pressure Pump Inlet Valve chamber.

High Pressure Pump flow is normal when the system operating pressure is at zero, but the High Pressure Gauge does not register pressure as the Back Pressure Regulator Valve is adjusted. The Feed Water Flow Meter reads normal and normal Product Water Flow registers on the Product Water Flow Meter as the Back Pressure Regulator Valve is adjusted clockwise:

- Clean the debris from the High Pressure Gauge orifice or replace the gauge.

High Pressure Pump leaks oil:

- Locate the leak source and repair as required.

High-pressure pump leaks water from between the manifold and the crankcase housing:

- Worn inlet packings due to operating the High Pressure Pump dry or at a vacuum.
- Worn seals from normal wear, or degraded from age.
- Replace the High and Low Pressure Seals and associated O-Rings together as a set. Change these seals every 2,000 - 4,000

hours depending upon age and operating conditions.

8) Pressure Transducers:

- a) **High Pressure Transducer** The High Pressure Transducer shuts the System down as the System Pressure into the Back Pressure Regulator reaches 950 psi $\pm$ 50 psi (900 to 1000 psi setting is acceptable)

The System shuts down and the Low / High Pressure Fault Lamp illuminates when operating pressure does not exceed 900 psi

- The High Pressure **Transducer** has drifted from its factory setting and requires adjustment upward.

The System does not shut down when the operating pressure applied exceeds 1000 psi.

- The High-Pressure **Transducer** has drifted from its factory setting and requires adjustment downward.

- b) **Low Pressure Transducer** The Low Pressure Transducer closes as the Pre-filtration pressure rises above 6 psi ($\pm$ 2 psi) in order to maintain the System in operation. The Low Pressure Transducer shuts the System off as the Pre-filtration pressure drops, due to dirty Pre-filtration, below 4 psi ($\pm$ 2 psi).



NOTE: To prevent mistaking dirty Pre-filtration for a malfunctioning Low Pressure Switch, physically check the Low Pressure Switch Setting.

In order to check the Low Pressure Switch Setting:

With the system operating, slowly close the Inlet Sea Cock Valve. While closing this valve, view the Low Pressure (LP) Gauge while simultaneously viewing the LP/HP Fault Lamp. If the LP Transducer is properly adjusted, the LP/HP Fault Lamp blinks on and off as the Feed Water Pressure drops to between 6 to 2 psi. If the LP Fault Lamp blinks prior to 6 psi, the LP Transducer is set too high. If the LP Fault Lamp blinks only after pressure drops below 2 psi or does not blink at all, then the LP Transducer is set too low.

Adjust or replace the LP Transducer but first refer to: 1) *System shuts down by itself and a fault lamp is illuminated:*

9) Post Filtration Sub-System

Product water leaks from Product Water Tubing when 3 Way Product Diversion Valve energizes to direct water to Post Filtration:

- There is a blockage in the product water line from the system. Locate the blockage and correct it so that the Product Water Line is free and clear from the system to the product water storage tank.
- One or more of the post filters are plugged, change the plugged filter element(s).

Sulfurous (rotten egg) smell in the Product Water Storage Tank:

The system has sat for an extended period of time without operation and the biological slimes trapped within the Pre-filter have decayed and are producing hydrogen sulfite.

- Replace the Pre-filter Element(s) and clean their respective housings.
- Saturated Charcoal Filter Element, replace the element.
- Contaminated product storage tank(s), clean and chlorinate storage tank(s) as required.

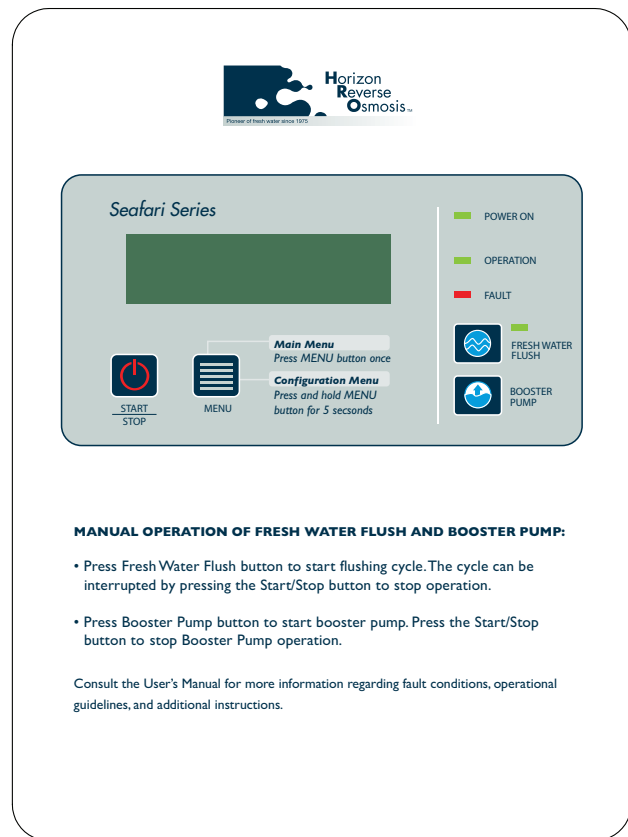
The Ultra Violet Sterilizer lamp continuously flickers or does not illuminate.

- Change the U.V. Lamp.
- The Voltage to the U.V. Sterilizer is too low. The U.V. Sterilizer ballast is very voltage sensitive. High voltage destroys the ballast, low voltage causes the lamp to continually flicker and eventually burn out. Ensure that the Voltage supplied is correct and within specifications.

10) Electronic Subsystem and Trouble Shooting Guide

a) Water Quality Indicator remains Red (Un-potable Water) for Extended Period.

- The R.O. Membrane Element is fouled or has been attacked by chemicals.
- The R.O. Membrane Element has a broken product water tube caused by a restriction in the Product Water Line.
- The R.O. Membrane Element Product Water O-Ring is worn, cut or pinched and requires replacement.



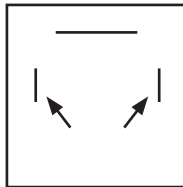
Above: Figure 7a - HRO Control Pad

- The Salinity Probe may have debris on it and requires cleaning.
- The Salinity Meter may require calibration. Check the actual salinity content of the product water with a portable TDS meter to determine if the R.O. Membrane Element is fouled.

b) Booster Pump:

If the Booster Pump fails to operate, follow these steps to isolate the problem.

1. Make sure the system is receiving proper power and the "POWER" LED is on.
2. Press "Booster Pump" switch to activate the motor. Do not press any other switch.
3. Measure the AC voltage between terminals 1 and 3 (single phase) or 1, 3 and 5 (3 phase) on TB-1 in the main power enclosure.
4. If the voltage measured in the step 3 matches the system voltage, then problems may be in the motor wiring or the motor itself.

5. If low or no voltage present in the step 3 above, then check for proper operation of the Booster Pump Contactor. To deactivate the contactor, press the "Stop" switch twice. To activate the contactor again press "Booster Pump" switch.
 6. If the contactor is mechanically operating, but no voltage present at the motor terminal (step 3 above), then the contactor may be at fault.
 7. If the contactor does not operate mechanically, then measure DC voltage between A1 and A2 terminals. It should read 12V DC when activated.
 8. If the contactor gets 12V DC, but inoperative, then its coil may be open. Replace the contactor.
 9. If 12V DC is not present when the booster pump is activated, trace yellow and yellow/black wires to TB-2 and measure the DC voltage at the terminals. It should read 12V when activated.
 10. If 12V DC is not present at the Booster Pump terminals, then disassemble Controller Enclosure and open the shell by removing 4 screws. This exposes the main controller circuit board.
- c) **Diversion Valve (3-Way Valve) Troubleshooting**
- If the Diversion Valve fails to operate, follow these steps to isolate the problem.
1. Disassemble Controller Enclosure and open the shell by removing 4 screws. This exposes the main controller circuit board.
 2. Disconnect 3 wires from "SAL PROBE" terminals temporarily after noting wire connections. (Main Printed Circuit "PC" Board) This fools the controller to "think" there is good water.
 3. Start the system.
 4. Approximately 10 seconds after the system starts, the Water Quality LED turns green from red. If this is not observed, then go to Salinity Level Calibration procedure.
 5. When the Water Quality LED is illuminating in green, disconnect a control cable connector at the Diversion Valve. If the solenoid inside of the valve is functioning, a distinct click sound is heard.
 6. If the valve is silent, measure the continuity of its solenoid coil as shown below.
- Measure the DC resistance between pins 1 & 2.
- It is approx. 12 to 15 Ω
7. If the resistance value is abnormal (shorted or open), then replace the Valve.
 8. If resistance value is OK, then measure the DC voltage at the connector, pins between 1 & 2. This should be 12V.
 9. If the voltage is 0 on the step above, measure a DC voltage on the terminals marked as "3WAY" on the Control Circuit board. If there is 12V present, then check the connecting cable between the Valve and Circuit board.
 10. If no voltage indication on the terminals, check to see if the "3-WAY VALVE" LED is illuminated on the board. If it is off, then replace the Control board.
- 
- d) **High Pressure Pump:**
- If the High Pressure Pump fails to operate, follow these steps to isolate the problem.
1. Make sure the system is receiving a proper power and the "POWER" LED is on.
 2. Press "Start" switch to activate the motor. It will take approximately 5 seconds before the High Pressure Pump Motor to start. Do not press any other switch.
 3. Measure the AC voltage between terminals 8 and 10 (single phase) or 8, 10 and 12 (3 phase) on TB-1 in the main power enclosure.
 4. If the voltage measured in the step 3 above matches the system voltage, then problems may be in the motor wiring or the motor itself.
 5. If low or no voltage present in the step 3

above, then check for a proper operation of the High Pressure Pump Contactor. To deactivate the contactor, press the "Stop" switch twice. To activate the contactor again press "Start" switch.

6. If the contactor is mechanically operating, but no voltage present at the motor terminal (step 3 above), then the contactor may be at fault.
7. If the contactor does not operate mechanically, then measure DC voltage between A1 and A2 terminals. It should read 12V DC when activated.
8. If the contactor gets 12V DC, but inoperative, then its coil may be open. Replace the contactor.
9. If 12V DC is not present when the High Pressure Pump is activated, trace orange and orange/black wires to TB-2 and measure the DC voltage at the terminals. It should read 12V when activated.
10. If 12V DC is not present at the High Pressure Pump terminals, then disassemble Controller Enclosure and open the shell by removing 4 screws. This exposes the main controller circuit board.

If the voltage is present but the High Pressure Pump Contactor does not activate, then check cable connections between the Controller Enclosure and Main Power Enclosure.

- 7 e) Salinity Meter registers potable water, but the product water has a definite salt taste.

There is a blockage in the Brine Discharge Line causing Brine Discharge Water intrusion into the 3-way Product Water Diversion Valve. The 3-way Product Water Diversion Valve Seats have been tampered with and require proper adjustment.

The Salinity Probe may be dirty and requires cleaning

- f) Fresh Water Flush Adjustment

1. Put the system in stand-by pressing the FRESH WATER FLUSH switch activates the Automatic Fresh Water Flush operation and subsequent 7 day repeat cycle. The FWF duration must be set properly in order to enable the FWF function (see calibration mode below).

2. When the FWF duration is properly set, the system automatically goes into the FWF mode to perform the operation every time the system is in the normal operating mode and the STOP switch is pressed once.
3. To stop the FWF operation the STOP switch can be pressed anytime the system is performing the Fresh Water Flush operation.
4. After the Fresh Water Flush completes the system goes into a 7 day stand-by mode. The Fresh Water Flush cycle will repeat every 7 days until the STOP switch is pressed.
5. If a low level switch is installed and the water tank low level condition is detected the FWF does not start and reverts to the system stand-by mode.
6. If the power is lost during the FWF operation the FWF operation restarts when the power is restored.
7. If the power is lost during the 7-day waiting period the waiting period resumes counting from the point of the power loss when the power is restored.

Fresh Water Flush Calibration:

1. Pressing the FRESH WATER FLUSH switch allows the Fresh Water Flush time duration to be calibrated.
2. Adjust R71 (FWF) for desired duration of the Fresh Water Flush operation. Note, on the average the flow rate of fresh water through the System during the Fresh Water Flush Cycle will be approximately .75 U.S. Gallons Per minute or 2.8 Liters Per Minute.

A system equipped with only 10 inch pre filters will require about 5 U.S. Gallons or 6 to 7 minutes duration.

A system equipped with Commercial Prefilter and Oil Water Separator will require about 8 U.S. Gallons or 10 minutes duration.

A system equipped with Commercial Prefilter, Oil Water Separator, and Multi Media Filter will require about 10 U.S. Gallons or 12 to 14 minutes duration.

3. The LED meter indicates the FWF duration in 2 minute increments and adjustable range is between 1 and 17 minutes. If R71 is set to less than 60 seconds (i.e. turned fully counter clockwise for 20 turns) then the FWF function is disabled.
- g) "Start" switch is depressed but the system does not attempt to start:

Fault LED lamp is illuminated and requires resetting by pressing Fault Reset Switch at the touch pad.

Power Source Line is switched off, reset the Power Source Circuit Breaker.

Blown fuse in the controller, check fuse condition.

Micro Processor has locked up due to a voltage spike from the Power Source. Turn power off for a minimum of 20 seconds to reset the Micro Processor.

Power source is dropping below the industry standard of 15%, at the instant of starting, preventing the electronic circuit from latching. Check the power source to ensure that it continually delivers the proper power to the System. If voltage drops below acceptable standards for even a micro second this causes the electronic circuit to not latch.

Controller is wired improperly or there are loose wires, check wiring with proper wiring diagram

Start switch at the touch pad is defective and not closing to make the circuit.
- h) "Stop" switch is depressed but the system does not attempt to stop:

Micro Processor has locked up. Turn power off for a minimum of 20 seconds to reset the Main PCB.

Stop switch at the touch pad is defective and not closing to make the circuit.

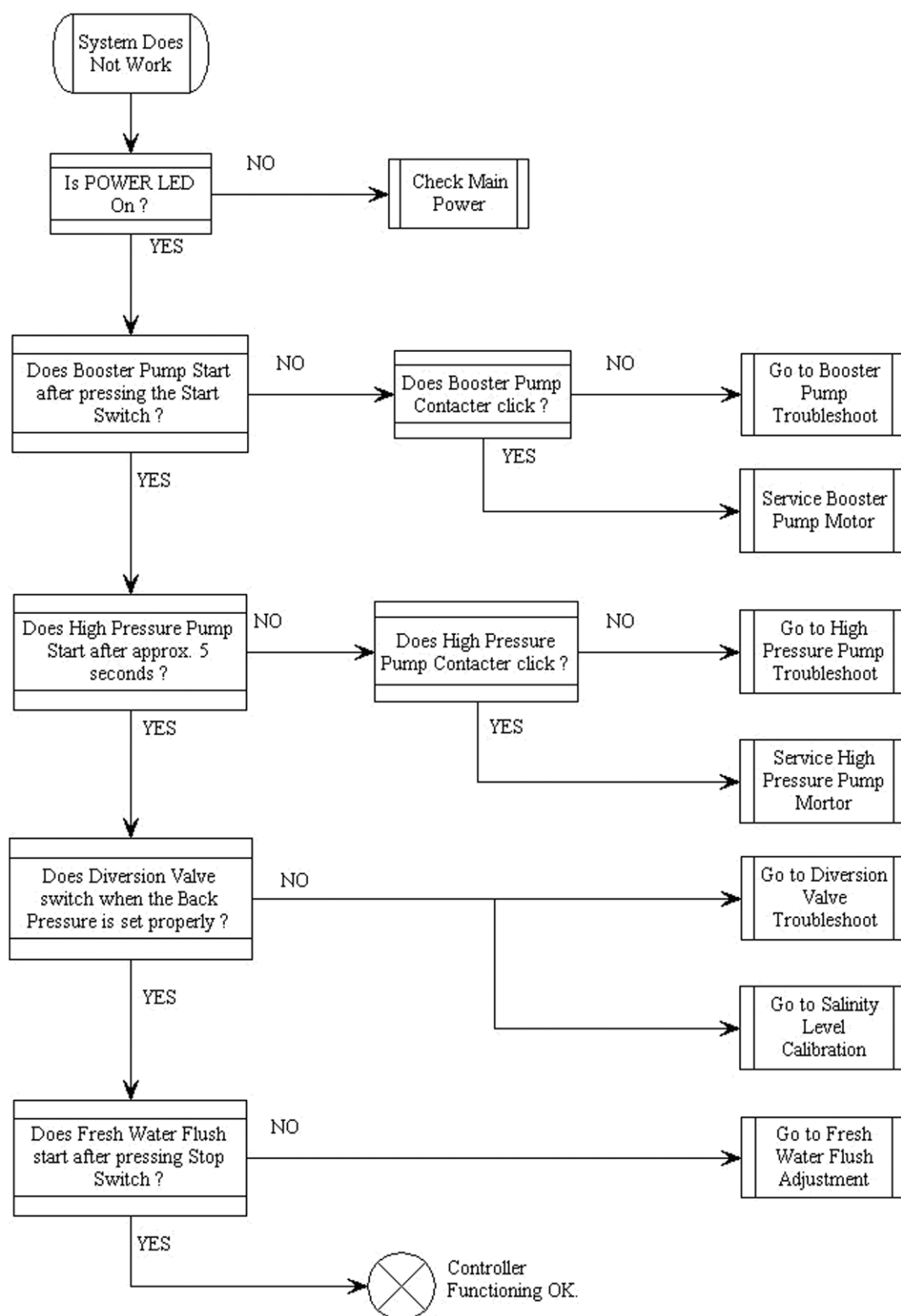
Water damage to the printed circuit board is shorting the stop circuit and causing the system to remain in operation.
- i) Fuse in controller blows at start up:

Low or high voltage into the system, correct at the source into the system.

Defective component that relies on the fuse for power:

 - 3-way solenoid valve
 - U.V. Sterilizer
 - Printed Circuit Boards
 - Touch Pad
 - Shorted wire, locate shorted wire and repair it.

Electrical Troubleshooting Diagram



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8

STORAGE AND CLEANING

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8 STORAGE AND CLEANING

8.1 R.O. MEMBRANE ELEMENT HANDLING & SYSTEM STORAGE CAUTIONS

 **TEMPERATURE CAUTION:** Never expose the HRO R.O. membrane(s) to storage temperatures above 122° F / 50 C or below 32° F / 0 C. Never store the R.O. membrane assembly in direct sunlight. High temperature causes up to 40% flux loss (loss of production) of the R.O. membrane element(s). This damage is irreversible. Freezing temperatures cause mechanical damage to the HRO system. This damage is irreversible to the R.O. membrane element.

 **DRYING OUT CAUTION:** Never allow the R.O. membrane element to dry out, as 40% flux loss occurs. This damage may be irreversible to the R.O. membrane element. The R.O. membrane element(s) must remain wet at all times.

 **BIOLOGICAL FOULING CAUTION:** Protect the R.O. membrane element from biological fouling. Up to 40% flux loss occurs if the element becomes fouled by biological slimes. Some, but not all, flux may be regained after thorough cleaning.

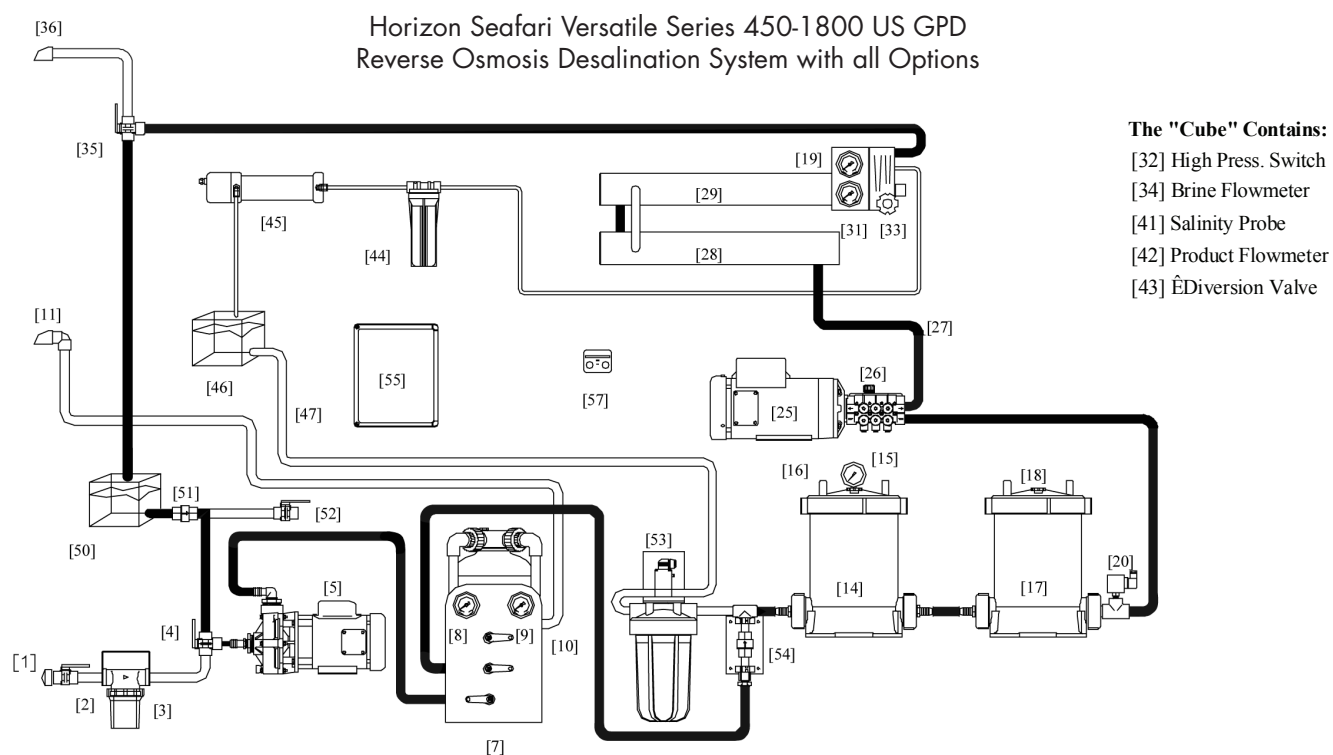
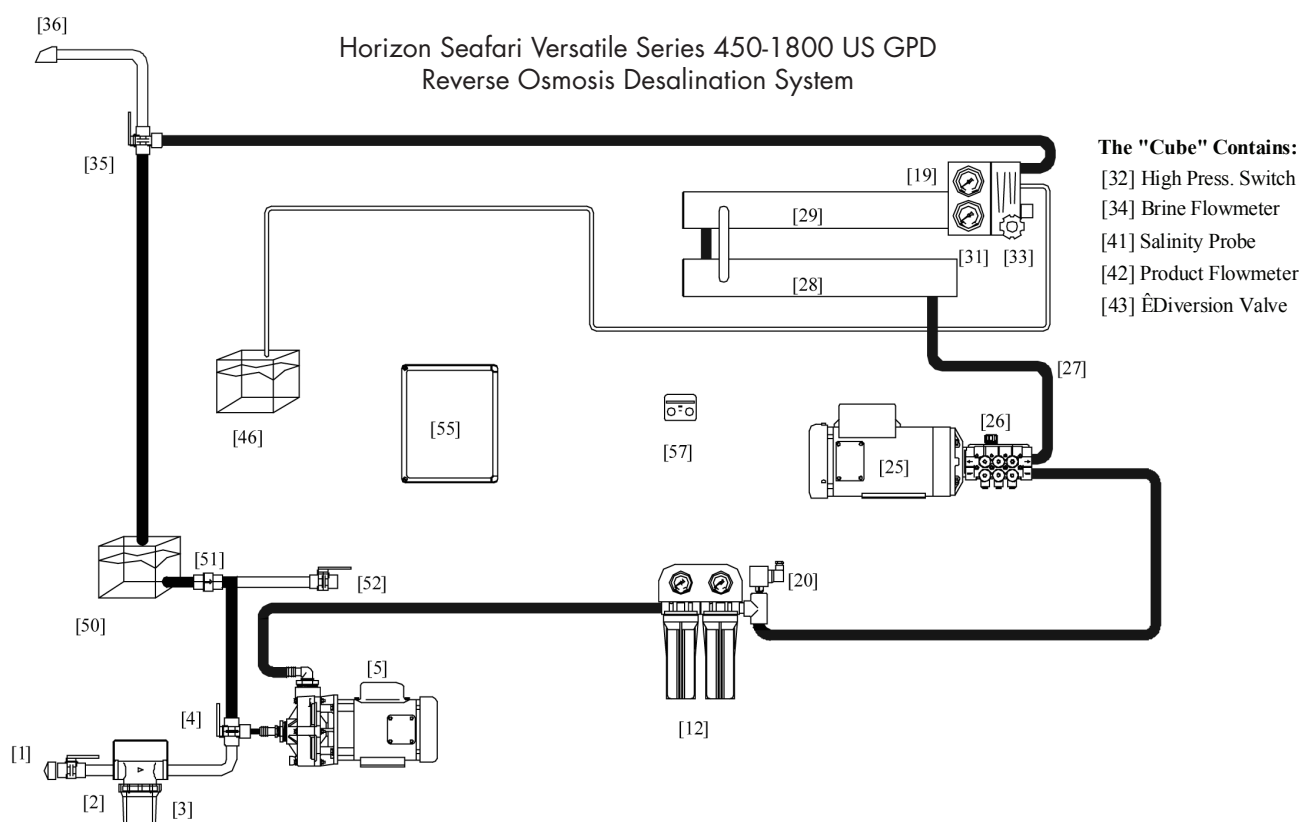
 **CHEMICAL FOULING CAUTION:** Never expose the R.O. Membrane Element to chemicals other than those supplied by HRO. Use caution when operating the System in harbors that may be polluted with chemicals, oil, or fuel. Chemical attack to the R.O. Membrane Element may damage the element beyond repair. Chemical attack of the R.O. Membrane Element is not covered by warranty.

 **STORAGE CAUTION:** The interior of a membrane element, being dark and moist, is an excellent breeding ground for microorganisms. Simply operating the system does not protect the R.O. Membrane Element(s) from biological fouling. Up to 40% flux loss due to

biological fouling occurs in the element if it is not stored properly. During short-term shutdowns the membrane element must be rinsed as explained in the following pages. During long-term shutdowns the membrane element must be rinsed as well as chemically treated as explained later in this chapter.

 **NEW SYSTEM STORAGE CAUTION:** The Horizon Seafari system has been tested at the factory and rinsed with a mild mixture of storage chemical. This allows the system to be stored for up to 3 months if kept in a cool place. Do not store the system for longer than 3 months prior to actual use. If storage of the new system is longer than 3 months the system must be rinsed with fresh water and restored with storage solution every 3 months otherwise biological fouling and or drying out damages the R.O. Membrane Element.

Closed-Loop Clean/Rinse Operation



8.2 SHORT-TERM SHUTDOWN

A short-term shutdown is defined as a period of time in which the Horizon Seafari system is not utilized for two to fourteen days. An efficient short-term method of protecting the HRO system and R.O. membrane element is to perform a “once through” Fresh Water Rinse of the entire system with fresh water (product water from the system). This prolongs the system life by minimizing electrolysis and retarding biological growth. Refer to section 6.2.2, page 6-4 for complete explanation of the Fresh Water Flush System.

One time through fresh water rinse procedure:

(refer to Fig 8a - 8b, pg. 8-3) Follow the directions below.

This procedure displaces the system feed water with fresh water and allows a short-term shutdown for up to two weeks. 10 to 20 gallons (38 to 75 liters) of fresh product or potable water is required depending upon the Optional Pre-filtration included with the system.

1. Close the Inlet Sea Cock Valve [2].
2. If not already connected, connect the RINSE/CLEAN INLET line from the Rinse/Clean Inlet Valve [4] to the pick up point of the Rinse/Clean Tank [50].
3. Fill the Rinse/Clean Tank [50] full with non-chlorinated product water. The cleaning tank must contain enough product water to sustain rinsing of the system until all of the feed water is displaced. This process requires approximately 10 to 20 gallons (38 to 75 liters).

 **NOTE: Winterizing and freezing temperature storage** - If the system is exposed to freezing temperatures add twenty percent (2 to 4 gallons / 8 to 15 liters) food grade glycerin (propylene glycol) to the rinse water. This prevents the water in the system from freezing.

4. Position the Rinse/Clean Inlet Valve [4] to the Rinse/Clean Tank position.
5. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge (normal operation) position.
6. Fully open the Back Pressure Regulating Valve [33].
7. Operate the system by pressing the “Start” switch. The fresh water rinses the entire Horizon Seafari system and discharges out to waste.

8. Apply 200 psi of pressure to the System by turning the Back Pressure Regulator Clockwise. This allows the system to produce a minimal amount of product water, which ensures that the product water line remains wet.
9. Just prior to depleting the rinse water from the tank, stop the system.
10. Position the Rinse/Clean Inlet Valve [4] to the Normal Operating Position towards the Sea Strainer [3]. The system is now exposed to fresh rinse water and may be left unattended for up to two weeks. This procedure should be repeated every two weeks if the system is not in use.

 **NOTE:** If the Horizon Seafari is equipped with a Fresh Water Flush system, the fresh water flush is a substitute for the above procedure. The Fresh Water Flush is timed and repeats every seventh day unless the “Stop” switch is pressed, or the power supply is interrupted.

8.3 LONG TERM SHUTDOWN

A Long Term or Prolonged Shutdown is defined as a period in which the HRO system is shut down for longer than three months. For a such a shut down, the system should first be rinsed with fresh water, then stored with HRO SC System and Membrane Element Storage Chemical. This chemical inhibits bacterial growth while maintaining the high flux and salt rejection of the HRO R.O. Membrane Element. Follow the directions listed below.

The Long Term Shutdown procedure requires 20 - 40 gal. (75 - 150 liters) of potable water.

1. Backwash and rinse the Multi Media Filter, if installed.
2. Close the Inlet Sea Cock Valve [2].
3. Replace all of the Pre-filtration Cartridges with new HRO Pre-filtration Elements.
4. If not already connected, connect the RINSE/CLEAN INLET line from the Rinse/Clean Inlet Valve [4] to the pick up point of the Rinse/Clean Tank [50].
5. Fill the Rinse/Clean Tank [50] full with non-chlorinated product water. The cleaning tank must contain enough product water to displace all of the feed water. This requires approximately 10 - 20 gallons (38 - 75 liters).

6. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge (normal operation) position.
7. Open the Back Pressure Regulating Valve [33] full open counter clockwise.
8. Start the system. The rinse water is now rinsing the entire system and discharging to waste.
9. Apply 200 psi of pressure to the System. This produces a minimal amount of product water, which ensures the product water line remains wet.
10. Just prior to depleting the rinse water from the tank, stop the system.
11. Open the Back Pressure Regulating Valve [33] full open.
12. Add 10 - 20 gal. (8 - 15 liters) of product water to the Rinse/Clean Tank.
13. Fill a separate plastic bucket or container with 1 to 2 gallons of product water. Add the HRO SC Storage Chemical to the water in the bucket as follows:

Mix and thoroughly dissolve the solution in the container. Pour the dissolved solution contents into the Rinse/Clean Tank [50].



NOTE: The correct mixture ratio for the Storage Chemical (SC) is one bottle per 20 gallons of product water. The chemical is mixed first in a small bucket and then added to the water in the tank. This makes the chemical easier to dissolve into the water.

Mixture example 1: If the Rinse/Clean Tank [50] contains 10 gallons of product water then add 1/2 bottle of the SC Storage Chemical.

Mixture example 2: If the Rinse/Clean Tank [50] contains 20 gallons of product water then add a full bottle of the SC Storage Chemical.

NOTE: Winterizing and freezing temperature storage - If the system is exposed to freezing temperatures, add 2 - 4 gal. (8 to 15 liters) of food grade glycerin (propylene glycol) is

also added to the final storage chemical mixture to prevent the water in the system from freezing.

14. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] return for a Closed Loop re-circulation.
15. Operate the system by pressing the System Start Switch. The Storage Chemical Solution is now flows from the Clean/Rinse Tank, through the System and back into the Clean/Rinse Tank in a Closed Loop configuration. Do not pressurize the system above 50 psi maximum.
16. After approximately 20 minutes of re-circulation, stop the system.
17. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
18. Operate the system, which discharges the Storage Chemical Mixture through the Brine Discharge Thru Hull Fitting.
19. Stop the system just before depleting the Storage Chemical Solution from the tank.
20. Position the Rinse/Clean Inlet Valve [4] to the normal operating position.

The system may now be left unattended for up to 3 to 6 months. With ideal conditions including a relatively new R.O. Membrane Element, a clean system prior to storage, cool temperatures, and no leakage of storage chemical within the system, it provides protection for up to 6 months. Adverse conditions provide only a month or less of safe storage. Evaluate these factors before determining the proper interval between repeated rinsing and storage periods.

8.4 R.O. MEMBRANE ELEMENT CLEANING PROCEDURE

Do not arbitrarily clean a New System. Low product water production and or High Salinity Product Water readings from a New System is likely due to factors other than fouling. If a New System experiences low production or high salinity then the New System should be operated for up to 12 or more hours continuously to clear the R.O.

Membrane Element and product water channel. If, after 12 hours of continual operation, the system still experiences low production and or high salinity then contact the factory.

The membrane elements require cleaning from time to time. Biological growth and salt accumulation eventually make replacement necessary. The frequency of required cleaning is dependent on the rate of production loss and salt rejection loss caused by normal use. In order to properly assess performance changes, it is important that daily log readings be made and referred to for comparison.

When determining the percentage of performance changes, Feed Water Temp, Feed Water Salinity, and System Operating Pressure must be taken into consideration (Refer to Section 12) and compensate for those variables. After compensations, a 10% decline in productivity (GPH Flow) and/or a 10% increase in salt passage indicate that the R.O. Membrane Element requires cleaning.

If Production rate has dropped dramatically since the last time the system was used, this may be due to drying out of the R.O. Membrane Element(s) and/or fouling during storage. If the system has not been used for several months and the production rate has dropped dramatically since the last time used, try operating it for 12 or more continuous hours to saturate the Product Water Channel within the R.O. Membrane Element.

If Production rate has dropped dramatically from one day to another then the reason for production drop may be due to chemical attack or suspended solids fouling, which is not likely cleanable. Chemical attack can be from sewage chemicals or petroleum products. Suspended solids fouling usually consists of silt, coral dust, or debris in rivers or inland waterways, or any other small solid matter.

8.5 R.O. MEMBRANE ELEMENT CLEANING CAUTIONS AND INFORMATION

The Horizon Seafari R.O. system must be rinsed with fresh water before beginning any cleaning procedure. Cleaning of the R.O. Membrane Element(s) with the HRO CC R.O. Membrane Element Cleaning Chemical is performed as follows: (Refer to the diagrams on page J-3 when rinsing and closed loop cleaning the system.)

The process of rinsing and cleaning the R.O. Membrane Elements requires 40 to 200 gallons / 151 to 757 liters of fresh non-chlorinated product water.

The amount of fresh water required depends upon which cleaning chemicals are used and the different Pre-filtration equipment installed.

Product Water Required For Cleaning of the R.O. Membrane Element(s):

System with the Standard Pre-filtration only:

Chemical	Rinse	Clean	Recirc. Rinse	Final	Total water used
HRO CC-1	10	10	10	10	40
HRO CC-2	—	10	10	10	70
HRO CC-3	—	10	10	10	100

If the System Includes Commercial Pre-filtration and Oil Water Separator:

Chemical	Rinse	Clean	Recirc. Rinse	Final	Total water used
HRO CC-1	20	20	20	20	80
HRO CC-2	—	20	20	20	140
HRO CC-3	—	20	20	20	200

The cleaning compounds available from HRO are designed to clean the R.O. membrane elements in a closed-loop configuration. These Chemicals are designed to clean moderate fouling. If the R.O. Membrane Elements are excessively fouled and in-field cleaning is not successful the R.O. Membrane Element(s) may be returned to HRO Systems or to one of HRO Systems' many Service Dealers for more controlled and stronger chemical cleaning. If you wish HRO Systems to perform cleaning of the R.O. Membrane Element, contact us for a Return Authorization Number, price quotation and return instructions.

HRO CC-1, Cleaning Compound "# 1" is an alkaline cleaner designed to clean biological fouling and slight oil fouling from the R.O. Membrane Element. Biological fouling is usually the first cause of the R.O. Membrane Element fouling. The system is constantly exposed to seawater, and biological growth occurs from the first day forward. If exposed to seawater and left to sit, the R.O. Membrane Elements become unusable and un-cleanable even with no actual system use. This fouling can only be minimized with fresh water rinsing whenever the system is not in use.

HRO CC-2, Cleaning Compound “# 2” is an acid cleaner designed to clean calcium carbonate and other mineral deposits from the R.O. Membrane Element. Mineral fouling is usually a very slow process, which takes place over many hours of use. Therefore, if the System has relatively few hours of use yet shows signs of R.O. Membrane Element fouling then that fouling is likely biological fouling. If the System has in excess of 1000 hours of use then there may be some mineral fouling combined with biological fouling.

HRO CC-3, Cleaning Compound “# 3” is used for iron fouling only and is not included in the HRO CC kit. If the HRO R.O. membrane elements are fouled with rust from iron piping then HRO CC-3 may be used for effective rust removal of lightly or moderate rust fouling. R.O. Membrane Elements, which are heavily fouled with rust may not be recoverable as rust not only fouls the Membrane Element but also damages the membrane surface.



CAUTION: DO NOT mix different cleaning chemicals together at the same time. Mix the cleaning chemicals separately and use the separately.

8.6 R.O. MEMBRANE ELEMENT CLEANING INSTRUCTIONS

1. Back Wash and rinse the Multi Media Filter, if installed.
2. Close the Inlet Sea Cock Valve [2].
3. Replace all of the Pre-filtration Cartridges with new HRO Systems supplied Pre-filtration Elements. **DO NOT INSTALL THE OIL/WATER SEPARATOR ELEMENT AT THIS TIME.**
4. If not already connected, connect the RINSE/CLEAN INLET line from the Rinse/Clean Inlet Valve [4] to the pick up point of the Rinse/Clean Tank [50].

The Rinse/Clean Tank should be minimum 10 to maximum 20 gallons in size.

5. Fill the Rinse/Clean Tank [50] full with non-chlorinated product water. The cleaning tank must contain enough product water to rinse the system until all of the feed water is displaced.
6. Position the Rinse/Clean Outlet Valve [4] to the Brine Discharge (normal operation) position.

7. Open the Back Pressure Regulating Valve [33] full open counter clockwise.
8. Operate the system by pressing the “Start” switch. The rinse water rinses the entire Horizon Seafari system and discharges out to waste.
9. Just prior to depleting the rinse water from the tank stop the system.
10. Refill the Rinse/Clean Tank [50] with 10 -20 gallons (38 - 75 liters) of non-chlorinated product water.
11. Fill a separate plastic bucket or container (1/2 to 2 gallons) 1/2 full with product water. Add the full contents of the HRO CC-1, CC-2, or CC-3 Cleaning Chemical to the water in the plastic bucket. **USE ONLY ONE CHEMICAL AT A TIME.**

Mix and thoroughly dissolve the solution in the container. Pour the dissolved solution into the Rinse/Clean Tank [50].



NOTE: The correct mixture ratio for the Cleaning Chemical (CC) is one bottle per 20 gallons of product water. The chemical is mixed first in a small bucket and then added to the water in the tank. This makes the chemical easier to dissolve into the water in the tank.

12. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] return for a closed-loop re-circulation to and from the Clean/Rinse Tank [50].
13. Press the “Start” switch to begin re-circulating the Cleaning Chemical solution from the Clean/Rinse Tank, through the System and back into the Clean/Rinse Tank. **Do not pressurize the system above 50 psi maximum.**
14. After approximately 60 minutes of re-circulation, stop the system.
15. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
16. Press the “Start” switch to discharge the solution out the Brine Discharge Thru Hull Fitting [36].
17. Just prior to depleting the Cleaning Chemical solution from the tank, stop the system.

18. Refill the Rinse/Clean Tank [50] with non-chlorinated product water.
19. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] for Rinse Re-circulation.
20. Press the “Start” switch to re-circulate the water from the Rinse/Clean Tank, through the system, and back into the Rinse/Clean Tank. Continue rinsing for 20 minutes.
21. After 20 minutes stop the system by pressing the “Stop” switch.
22. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
23. Press the “Start” switch to discharge the rinse water out the Brine Discharge Thru Hull Fitting [36].
24. Just prior to depleting the rinse water from the tank, stop the system.
25. Refill the Rinse/Clean Tank [50] with non-chlorinated product water.
26. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
27. Start the system to begin rinsing the System, and discharging out the Brine Discharge Thru Hull Fitting to waste.
28. Just prior to depleting the Final Rinse Water from the tank stop the system.

The System is now ready for additional cleaning, Storage, or use.

If further cleaning is necessary, repeat steps 10 through 28 for each additional cleaning.

If cleaning is completed and the System is to be stored, go to the beginning of this section and review the Storage Procedures and Cautions.

If cleaning is complete and the System will be operated again within a short period of time, proceed to step 29 below.

29. Position the Clean/Rinse Inlet Valve [4] towards the Sea Strainer, normal operating position.

9

MAINTENANCE AND REPAIR

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9 MAINTENANCE AND REPAIR

9.1 OPERATORS PREVENTIVE MAINTENANCE

Weekly or approximately every 50 hours of use, the Horizon Seafari system should be inspected as part of a preventive maintenance program. The following steps ensure that potential problems are resolved preventing major repairs.

1. Inspect all fasteners for tightness including brackets, screws, nuts, and bolts. Pay special attention to the High Pressure Pump [26] and Electric Motor [25] since they are subject to increased vibration.
2. High Pressure Pump [26]: Regularly check the level of the crankcase oil. The minimum oil level is the center of the sight glass, located at the rear of the High Pressure Pump. The maximum oil level is the top of the sight glass and this level does not harm the pump.

Use only HRO PO High Pressure Pump oil. DO NOT USE MOTOR OIL OR OTHER HYDRAULIC OIL.
3. Regularly clean any salt water or salt deposits from the system with a wetted rag.
4. Check regularly for fluid leaks; either oil from the High Pressure Pump or water from anywhere in the system.
5. Regularly check all tubing and high-pressure hoses for wear and friction against abrasive surfaces. Do not allow hoses to come in contact with heated or abrasive surfaces.

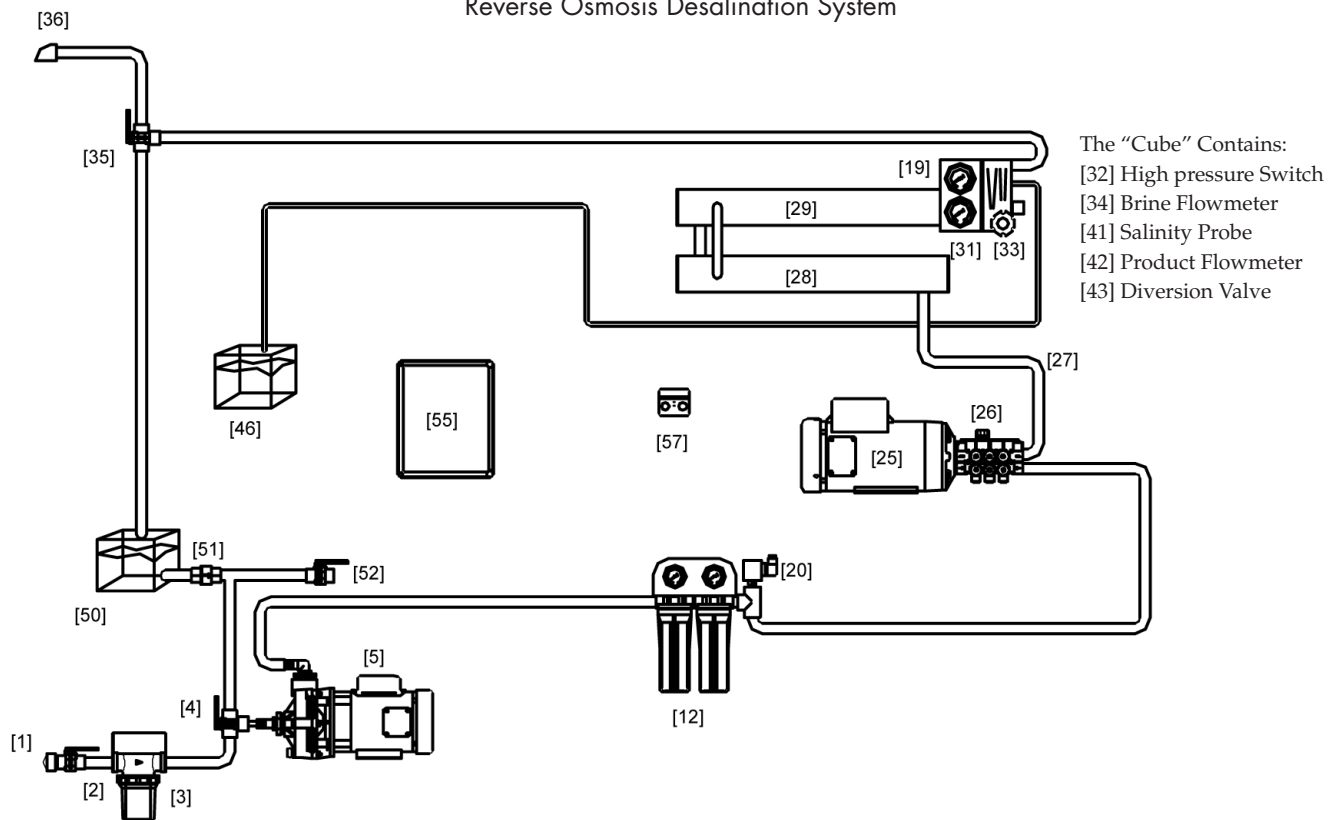


CAUTION: Make sure that the System Feed Water Sea Cock Valve [2] is closed prior to performing maintenance on the Horizon Seafari system. Also, make sure that the system main electrical disconnect switch is switched “OFF”, LOCKED, and TAGGED FOR MAINTENANCE prior to performing maintenance or repairs.

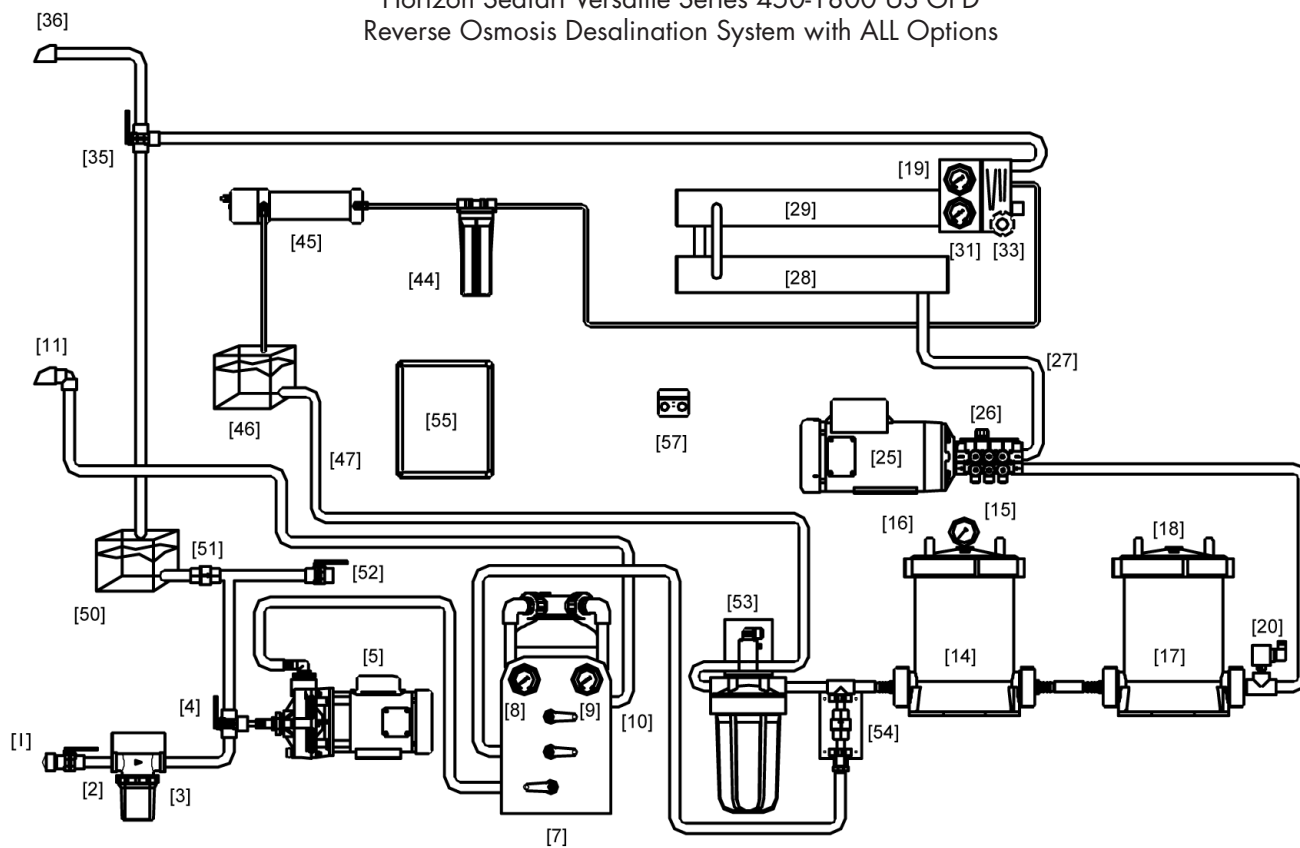


NOTE: Refer to Section 10 “EXPLODED PARTS VIEWS” of this MANUAL while performing maintenance or repairs of the individual components and subassemblies. Always observe position of all parts during disassembly.

Horizon Seafari Versatile Series 450-1800 US GPD Reverse Osmosis Desalination System



Horizon Seafari Versatile Series 450-1800 US GPD Reverse Osmosis Desalination System with ALL Options



9.1.1 OPERATOR MAINTENANCE TIMETABLE

The frequency of required maintenance is dependent on the regularity of usage, the condition of the intake water (the location of use), the length of time the system is exposed to water, the total running time and, in some cases, the manner in which the System is installed. Because of these factors, it is virtually impossible to comprise an exact timetable for

required maintenance. The following maintenance timetable is an estimate of the time intervals at which maintenance may be required on the various systems components. This is based upon factual data compiled from HRO system installations around the world. However, this schedule must be adjusted to each individual system depending upon the variables listed.

COMPONENT	MAINTENANCE REQUIRED	TIME INTERVAL CONTINUOUS	TIME INTERVAL INTERMITTENT DUTY
Sea Strainer	Inspect & Clean Screen & Housing	Weekly	100 hours
Booster Pump	Replace Seal	2000 hours / if seal leaks	2000 hours / if seal leaks
Plankton Filter	Inspect & Clean	Weekly	100 hours
Multi Media Filter	Back wash & Rinse	When pressure drops 20 PSI (1.37 BAR) across the filter	
Pre-filter	Replace element(s)	Low Pressure <10 psi (0.68 BAR)	Low Pressure <10 psi (0.68 BAR)
Oil/water Separator	Replace element	Low Pressure <10 psi (0.68 BAR)	Low Pressure <10 psi (0.68 BAR)
Standard HP Pump	Change Oil Replace Seal Kit Replace Valve Kit	500 hours 2000 hours/as required 2000 hours/as required	500 hours 2000 hours/as required 2000 hours/as required
Optional HP Pump	Internal Service	Approx. 8000 hours	
R. O. Membrane	Clean Element	When production or salt rejection decreases by 10%	
Salinity Probe	Clean Probes	Annually	Annually
Charcoal Filter	Replace Element	3 months	3 months
pH Neutralizing Cartridge	Replace Cartridge clean quartz sleeve	When calcium carbonate granules are depleted	
UV Sterilizer	Replace lamp & clean quartz sleeve	2000 Hours	2000 Hours
Fresh Water Flush Charcoal Element	Replace Element	3 months	3 months

9.2 COMPONENT MAINTENANCE & REPAIR

1. **Inlet Thru Hull Fitting [1]:** Keep the Inlet Thru Hull Fitting free and clear of debris and marine growth. If the Inlet Thru Hull Fitting is clogged, this results in a low feed pressure condition, which causes the System to shut off.
2. **Inlet Sea Cock Valve [2]:** The packings and connections of the Inlet Sea Cock Valve must be tight and must properly seal. Clean the valve cavity of debris or replace the seal and seat, or the entire valve, as required.
3. **Sea Strainer [3]:** Keep the mesh screen free and clear of debris. The Sea Strainer contains a very fine monel mesh screen designed to trap marine debris prior to entering the Booster Pump and Pre-filters. If the mesh screen becomes clogged, it results in a low-pressure condition causing system shut off.

Standard Sea Strainer: To clean or replace the standard mesh screen remove the bowl by turning it counter clockwise. Remove the Mesh Screen from the bowl. Remove the flat sealing gasket from the bowl and take care to not damage it.

Wipe the sealing gasket with a damp cloth. Lubricate it sparingly with Parker "O" ring lubricant. Place the seal back onto the bowl. Seat the mesh screen back into the bowl. Screw the lid on clockwise. Hand-tighten only enough to seal water in and air out.

Commercial Sea Strainer: To clean or replace the mesh screen remove the cap on the top by turning it counterclockwise by hand or with a spanner tool. Lift the Mesh Screen from the bowl. Clean the mesh screen and lower it back into the bowl. Ensure that the seal on the cap is undamaged and free from debris. Replace the cap making sure the seal is seated properly.

4. **Booster Pump [5]:** Replace the ceramic seal approximately every 2000 hours, or at the sign of leakage. (P/N HRO BPSK-5):

Disassembly: Remove the seven bolts holding the volute to the motor bracket. To remove the impeller, hold the motor shaft with a large screwdriver and remove the impeller by grasping it with your hand and turning the impeller counter clockwise. Remove the Seal.

Reassembly: Clean the motor shaft and the bracket of any corrosion or salt deposits. Place the ceramic seat into the cavity over the shaft. Make sure that the polished side is toward

the end of the shaft. Tap into place evenly using a hollow piece of wood or plastic tool. Lubricate the shaft with light oil and slip the rotating portion of the seal over the shaft with the carbon element toward the ceramic. Slide it onto the shaft as far as possible. Apply blue Loctite to the motor shaft threads. Hold the Motor shaft and reinstall the impeller. Tighten the impeller by turning it clockwise until it is snug. Reinstall the volute. Tighten the bolts evenly. Thoroughly prime the pump.

The Electric Motor requires front and rear shaft bearing lubrication every 6 months. Give three pumps of high temperature motor bearing lubricant into each grease jerk. Use a Polyurea Base Grease such as Chevron SRI (Polyurea Base) or Shell Dolium R (Polyurea Base). **DO NOT USE LITHIUM OR SILICONE BASE GREASE.**

5. **Plankton Filter [6]**
Element Cleaning: To clean the element, unscrew the blue bowl counter clockwise. Remove the Plankton Filter Element from the bowl. Remove the O-Ring from the top of the bowl and take care to not damage it. Clean the mesh screen filter element with a bristle brush and water spray.

Wipe the O-Ring with a damp cloth. Lubricate it sparingly with O-Ring lubricant. Place the O-Ring back onto the bowl. Insert the cleaned, or a new, plankton filter element into the bowl. Screw the bowl on clockwise.
6. **Multi Media Filter [6]:**
Backwashing: When the Media Filter becomes packed with suspended solids, it must be backwashed. This process unpacks the silica sand and dislodges the suspended solids from the sand.

If replacing the media, the Multi Media Filter requires approximately 15 lbs (7 kg) of small gravel (1/8 x 1/4 inch) on the bottom then approximately 26 lbs (12 kg) of #20 silica sand on top of the small gravel.

To backwash the Multi Media Filter: Open the Inlet Sea Cock Valve [2]. Position the Inlet Clean/Rinse Valve [5], if installed, to the normal operating position towards the Sea Strainer [3].

Position the Multi Media Filter Valves (3 each valves) as shown in fig.9a, page 9-5: *Valves Positioned for Media Filter Back Wash*. Press

the “Booster Pump” switch. Allow this back washing to continue for 10 minutes.

After 10 minutes of back washing press the “Stop” switch to stop the Booster Pump.

Position the Media Filter Valves as shown in fig.9a, page 9-5 for Multi Media Filter Rinse.

Press the “Booster Pump” switch. The Booster Pump [5] now rinses the Multi Media Filter [7] to waste [11].

After 5 minutes of rinsing press the “Stop” switch to stop the Booster Pump.

Position the Multi Media Filter Valves as shown in the diagram below.

7. **Pre-filter Element Replacement:** The pre-filter elements must be cleaned, or replaced, when plugged to the extent that the Low Pressure Gauge at the control panel reads below 10 PSI. At or slightly below 6 PSI the Low Pressure Switch shuts the System off. The standard Pre-filters and the commercial Pre-filter are both discussed on the following page.

Standard Pre-filters [12]:

Element Replacement: To replace each individual element, unscrew the blue bowl by hand. Take care not to spill the feed water from the bowl. Remove the element from the bowls and discard them. Remove the O-Ring from the bowl and take care to not damage it. Clean the bowl with a mild detergent and rinse out thoroughly. Wipe the O-Ring with a damp cloth.

Lubricate the O-Ring sparingly with O-Ring lubricant. Place the O-Ring back onto the bowl. Place new HRO Supplied Elements into the appropriate bowls. The first Pre-filter receives an HRO PFE 10/25 Pre-filter Element. The second receives an HRO PFE 10/05 Pre-filter Element.

Screw the bowl on clockwise. Hand-tighten only enough to seat the O-Ring.

Commercial Pre-filter [14]

Element Replacement: Open the air bleed on top of the housing to allow the filter to drain. Open the drain valve located near the bottom of the base, if installed. After the water and residue have drained from the housing, unscrew the lid clamp. Remove the lid and attached O-Ring. Remove the pre-filter element and discard it. Clean the assembly

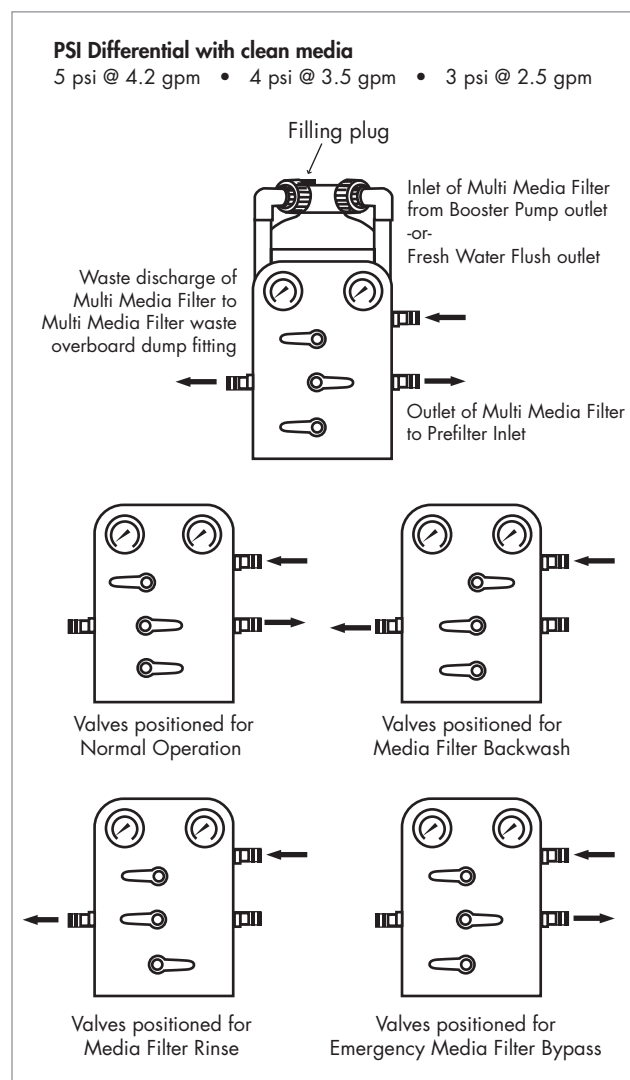


Figure 9a: Valve Positioning of the Multi Media Filter during 4 separate modes of Operation.

with product water and a cloth. Insert a new Pre-filter Element HRO CPFE into the housing. Lubricate the O-Ring with O-Ring lubricant, replace the lid, and replace the lid clamp hand tight.

DO NOT OVER TIGHTEN THE LID CLAMP. SNUG THE LID CLAMP HAND TIGHT ONLY.

Close the drain valve. Close the air bleed on top of the housing.

8. **Oil/Water Separator [17]**

Element Replacement: Open the air release valve on top of the housing. Open the drain valve located near the bottom of the base, if a drain valve is installed. After the water and residue have drained from the housing, unscrew the lid clamp. Remove the lid and attached O-Ring. Remove the Oil/Water Separator Element and discard it. Clean the

assembly with product water and a cloth. Insert a new Oil/Water Separator Element (HRO OWSE) into the housing. Lubricate the O-Ring with O-Ring lubricant, replace the lid, and replace the lid clamp hand tight.

DO NOT OVER TIGHTEN THE LID CLAMP. SNUG THE LID CLAMP HAND TIGHT ONLY.

Close the drain valve. Close the air release valve on top of the housing.

- 9 **Low Pressure Gauge** [19]: If the pressure gauge fails to register the orifice may be corroded with debris. Use a thin wire to dislodge any debris trapped within the pressure port orifice.
10. **High Pressure Pump** [26]: refer to pages 10-22 through 10-27 in the Users Manual:

Problem or Failure Signs and possible causes (troubleshooting):

Problem: Pulsations at the low pressure gauge, at the High Pressure Gauge and/or at the Brine Discharge Flow Meter.

Possible Cause(s):

- Worn or broken Valve
- Worn or broken Valve Spring
- Worn or broken Valve Seat
- Debris in Valve Chamber

Check Valve Chambers for debris and inspect Valves. Replace Valve assemblies as necessary

Problem: Water Leak between the High Pressure Pump Manifold and Rear Section.

Possible Cause: Worn Seals or Seals damaged due to running dry. Inspect Seals and change if necessary.

Problem: Flow drops dramatically when attempting to pressurize and there is no flow at the Product Flow Meter.

Possible Cause(s)

- Worn Seals
- Seals damaged due to running dry
- Broken Valve
- Broken Valve Spring
- Debris in Valve Chamber

Check Seals and Valve Chambers.

TORQUE SPECIFICATIONS:

Item	Description	Qty	Ft. Lbs of Torque
9	Screw SHCS 18mm Long	4	7.3
12	Screw SHCS 16mm Long	8	7.3
17	Screw HHCS 20mm long	1	10
29	Nut, Plunger Rod	3	7.3
45	Valve Plug	6	3.5
47	Screw SHCS 25mm Long	4	8
48	Screw SHCS 35mm Long	4	8

High Pressure Pump Drive End Disassembly for Servicing & Trouble Shooting

a. Servicing The Valves:

Tools required: 3/8" Drive Ratchet; 3/8" Hex Socket; O-Ring Pick; Torque Wrench; Needle Noise Pliers.

- 1) Only one valve kit is required to repair all of the valves in one pump. The Valve Kit (HRO HPP VK 4.2/SS) includes new valve O-Rings, valve seats, valves, springs, and cages, all pre-assembled.
- 2) All of the inlet and discharge valves can be serviced without disrupting the inlet or discharge plumbing.
- 3) To service any valve, remove the valve plug.
- 4) Examine the valve plug O-Rings and replace them if there is any evidence of cuts, abrasions or distortion.
- 5) Remove the valve assemblies (cage, spring and valve seat) by pushing the valve cage in any direction to unseat it then lift the valve cage assembly out with needle noise pliers.
- 6) Clean the Valve Seat Chamber of all debris, deposit build up and corrosion.
- 7) Inspect the manifold for wear or damage.
- 8) Insert a new valve assembly and squarely push it into place in the valve cavity.
- 9) Replace the valve plug and tighten it to the proper torque specification.

b. Removing The Manifold & Seals:

Tools Required: 3/8" Drive Ratchet; 5mm Hex Socket; Packing Extractor; and Colette.

- 1) Remove the manifold bolts and locking washers
- 2) To separate the manifold from the crankcase, grasp the manifold with both hands and pull straight off.
- 3) Normally the seal assemblies remain in the manifold, however part of the assembly may remain on the plunger. CAREFULLY side off these pieces.

To remove the seals insert a slide hammer/extraction collet into the seal. Tighten and pull up on the slide hammer weight. The seal assembly should come completely out.

- 4) Thoroughly clean the seal cavity.
- 5) Inspect the seal cavity for signs of damage.

c. Packing Installation:

Tools required: Seal Insertion Tool

- 1) Ensure that the seal cavities are clean and dry. Do not use lubricant.
- 2) Place a seal insertion tool in the seal cavity, and place one high-pressure seal squarely into the tool. The high-pressure seal consists of two pieces, the inner seal and the outer retainer. These parts are fragile so handle them with care.

Place the seal push tool on top of the seal and push the seal assembly into place. Repeat the process for the remaining cylinders.

- 3) Install the O-Ring in the outside groove on the low-pressure seal retainer. Next, install the low-pressure seal into the retainer with the closed portion of the seal being placed into the retainer, and push into place. Install the entire housing into the seal cavity with the seal opening in first.
- 4) Finally, install the seal retainer with the smooth side against the low-pressure seal retainer. The manifold is now fitted with new seals.

d. Plunger Inspection and removal:

Tools required: 3/8" Ratchet Driver; 13mm Socket; O-Ring Pick.

- 1) Inspect the plunger for any sign of damage (Surface scuffing/ scoring,

cracks, or pitting). The surface must be absolutely smooth.

- 2) Remove the plunger retaining nut and stainless steel washer (Note: This is the only area in the pump where a thread locker is used.) The washer may be stuck to the plunger. Use the O-Ring pick to clean off the thread locker and free the washer.
- 3) To remove the plunger, twist in either direction and pull straight off. DO NOT USE any type of pliers or metal tools on the plunger as they are ceramic and are brittle. Inspect the plunger again for any sign of damage also look into the bore of the plunger for any sign of rust. Rust here indicates that the plunger retainer O-Rings have failed, allowing water to leak between the manifold and crankcase and allowing for water to enter the crankcase section. Check the Crankcase Section for signs of water intrusion.
- 4) Remove the plunger O-Ring and anti-extrusion ring (Note: The anti-extrusion ring is cut at an angle) with the O-Ring pick. Once these are off, remove the slinger using needle nose pliers.



NOTE: Discard the slingers, DO NOT reuse them. They lose their original dimensions after use.

e. Plunger Installation:

Tools required: 3/8" drive Ratchet; 13mm socket; Torque Wrench; Medium Strength Thread Lock

- 1) Clean the old thread lock off the plunger rods. Do not use assembly lubricant.
- 2) Push the new slingers into place at the bottom of the plunger rods.
- 3) Carefully slide the new O-Ring into the groove on the plunger rods
- 4) Slide the anti-extrusion ring into the groove behind the O-Rings
- 5) Push the plungers onto the rods with a twisting motion until they are seated completely on the rods.
- 6) Place a new washer on the rod and apply a small amount of Loctite Medium thread

locker. Install the plunger retaining nut and torque to specification.

f. **Manifold Installation:**

Tools required: 3/8" drive Ratchet; 5mm socket; Soft Faced Hammer; Torque Wrench

- 1) Place the manifold squarely on the plungers and push with even tension until the manifold is seated against the crankcase. Do not use any lubricant.
- 2) Replace the manifold bolts and washers. Torque to specification.

Torque sequence for tightening the manifold:

1	8	6	4
X	X	X	X
X	X	X	X
3	5	7	2

- 11. **Electric Motor [25]:** The Electric Motor requires front and rear bearing lubrication every 6 months. Give three pumps of high temperature motor bearing lubricant into each grease zerc fitting. Use a Polyurea Base Grease such as Chevron SRI (Polyurea Base) or Shell Dolium R (Polyurea Base). **DO NOT USE LITHIUM OR SILICONE BASE GREASE.**
- 12. **High Pressure Hose [27]:** The High Pressure Hoses have no adjustment or repairable parts. For removal and replacement of a High Pressure Hose continue here.
 - a. **Removal:** When removing a High Pressure Hose use two open end wrenches. Hold the male flare fitting with one wrench while loosening the female swivel nut.
 - b. **Replacement:** When replacing a High Pressure Hose use two open end wrenches. Hold the male flare fitting with one wrench while tightening the female flare swivel nut clockwise. Snug finger tight then, with the open-end wrench, tighten 1/4 turn (90°) to obtain a metal-on-metal seal. Never use Teflon tape or pipe sealant on the flare surface or on the swivel nut threads.
- 13. **Reverse Osmosis Membrane Element [28 & 29]:** For cleaning of the Reverse Osmosis Membrane Element refer to Section 8 of

this Manual. For installation/replacement of the Reverse Osmosis Membrane Element continue here.

The Membrane Vessel Assemblies have a side port design. As such, dual membrane systems (740-2, 1160-2, and 1480-2) require the Membrane Vessel Assemblies to be removed from their respective frames prior to servicing. Access permitting, single R.O. Element systems (420-1, 630-1, and 840-1) may be serviced in place.

Dual Vessel System Preparation:

- 1.) Disconnect the Brine and Product tube connections located on the right side of the Control Manifold. Next, remove the four 1/4" nuts from the right side of the Control Manifold Assembly that hold it to the Membrane Vessel Assembly. Slide the assembly from the vessel and set in a secure place.
- 2.) Disconnect the High Pressure Hose [27].
- 3.) Remove the product tubing, black plastic fittings, and stainless steel nipple from the Membrane Vessel end plugs. (The vessels cannot slide out from the Vessel Frames if the product fittings remain attached)
- 4.) Next, loosen and remove the two 1/2"-13 hex cinch bolts on the Vessel Frame/Wall Mounted Vessel Frames. (These bolts slightly deflect these Vessel Frames to clamp the vessel. As such, the bolts are very snug.)
- 5.) Slide the Membrane Vessel out from the Vessel Frames. They may now be serviced.



CAUTION: Electrical Connections to the High Pressure Switch [32], the Diversion Valve [43], and the Salinity Probe [41] remain connected.

a.

Removal of the Reverse Osmosis Membrane Element:



NOTE: It is highly recommended to replace all O-Rings within the High Pressure Vessel assembly each time the Reverse Osmosis Membrane Element is removed or replaced. Each single High Pressure Vessel assembly contains a total of 6 O-Rings (4 each Brine O rings and 2

each Product Water O rings). Ensure that you have these O-Rings on hand prior to opening the High Pressure Vessel. One O-Ring kit is required for each High Pressure Vessel assembly.

The Pressure Vessel has a side port configuration, requiring removal of the port fittings prior to End Plug removal.

Disconnect the High Pressure Hose from the inlet end of the High Pressure Vessel Assembly.

Membranes are only installed and removed from the Inlet side of the High Pressure Vessel.

Using a 5/16" Allen wrench remove the 3 each Socket Head Cap Screws from the three-piece Segment Ring located at the end of the Pressure Vessel.

Push inward on the End Plug and Remove the three-piece segment ring.

Remove the Port Retainer.

Remove the High Pressure Port.

Insert all three of the Socket Head Cap Screws back into the End Plug. These Socket Head Cap Screws are used as a handle to remove the End Plug. Grasp one or more of the Socket Head Cap Screws with a pair of pliers and pull outward to remove the End Plug. There is some resistance due to the two Brine O-Rings exerting friction against the Vessel wall.

After the End Plug is removed, the R.O. Membrane Element End and Product Water Tube are exposed within the Vessel.



CAUTION: At each end of the Reverse Osmosis Membrane Element is a Product Water Tube approximately 3/4" diameter by 1" long. The outside diameter surface of this product water tube is a sealing surface, which isolates the Product Water from the Feed Water. The surface of the Product Water Tube must be scratch free. Never use pliers or other grabbing tools on or near the Product Water Tube.

With the End Plug removed from the High Pressure Vessel, the Reverse Osmosis Membrane Element is now visible in the exposed end of the High Pressure Vessel. With your fingers grasp the Product Water Tube and pull outward. If resistance is met then cup the open end of the High Pressure Vessel with one

hand and shake downward to dislodge the R.O. Membrane Element. Do not drop the R.O. Membrane onto a hard surface as the Product Water Tube may be damaged.

Run a rag through the High Pressure Vessel to remove any biological film or debris from the High Pressure Vessel.

- b. Inspection and O-Ring replacement: Inspect each End Plug assembly and its High Pressure Fittings for signs of wear. Inspect the O rings in the High Pressure Port fittings and replace them if they show signs of wear.

Remove the 2 Brine O-Rings and one Product Water O-Ring from all End Plugs removed from the High Pressure Vessel.

Clean the end plugs with a cloth and sparingly lubricate 2 new Brine O-Rings and one new Product Water O-Ring with O-Ring lubricant. Place them onto the End Plug.

- c. Installation/Replacement of the Reverse Osmosis Membrane Element:

A new HRO Reverse Osmosis Membrane Element comes from complete with a "U" cup Brine Seal at one end of the Element. This Brine Seal must be at the inlet end of the High Pressure Vessel. Refer to the Cross Sectional View on page 1-3.

Insert the down stream end (end without a brine seal) of the Reverse Osmosis Membrane Element into the upstream inlet end of the High Pressure Vessel. Slide the Membrane Element into the High Pressure Vessel, past the brine seal, until the Membrane Element product water tube is 4 inches past the end lip of the High Pressure Vessel.

Insert the End Plug with new attached O-Rings into the High Pressure Vessel while aligning the High Pressure Port and Product Water Port to the respective holes in the High Pressure Vessel. Continue pushing inward on the End Plug until it's exposed end travels just past the Segment Ring Groove in the Pressure Vessel. Ensure that the Ports of the End Plug are aligned with the Port Holes of the High Pressure Vessel.

Insert the High Pressure Port Fitting with attached O-Rings into the High Pressure Port.

Replace the Port Retainer.

Clean the threads of the Product Water Port Nipple and apply three wraps of new Teflon

sealing tape to the threads. Screw the Product Port Nipple into the Product Port clockwise until only 2 or 3 threads are exposed from the End Plug. Do not over tighten or use a wrench.

Insert the three-piece Segment Ring Set into the Segment Ring Groove of the High Pressure Vessel. Align the Segment Ring Set with the tapped holes in the End Plug for insertion of the three Socket Head Cap Screws. Attach the three Socket Head Cap Screws and tighten.

Reconnect the Plastic Product Water Tube. Screw the hex nut clockwise finger tight.

Connect the High Pressure Hose to both the leading end and discharge end of the High Pressure Vessel Assembly. Do not over tighten the female swivel nut.

14. **High Pressure Gauge [31]:** If the pressure gauge fails to register, the orifice may be corroded with debris. Use a thin wire to dislodge debris trapped in the orifice.
15. **Back Pressure Regulator [33]:** The Back Pressure Regulator Stem does not require maintenance. Should the O-Rings need replacement, remove the control manifold from the end of the Membrane Vessel Assembly. Carefully unscrew the High Pressure Gauge [31] and remove the cover. Remove the Flow Meter to access the Back Pressure Regulator shaft. Use customary care when replacing the O-Rings on the Back Pressure Regulator shaft.
16. **Flow Meter [34 & 42]:** Since the flow meter body is clear, light penetrates it and supports biological growth. To clean the flow meter body, remove the top access fitting, the guide rod, float and O-Ring bumpers and tube stops. Clean the interior of the tube using a bottlebrush, soft rag, cotton swab or other soft item. Reassemble the unit.
17. **Salinity Probe [41]:** The salinity probe requires cleaning once a year. To clean the probe, unscrew the probe from its tee housing. Using a soft bristle brush, scrub the probes to remove any built up debris. Remove all old Teflon tape from the male pipe threads of the Salinity Probe and clean the threads before reinstalling hand tight only.

18. **Charcoal Filter [44]:** A sulfurous (rotten egg) smell from the product water requires the replacement of the Charcoal Element. Otherwise, the Charcoal Element should be replaced every 3 to 4 months. It is not cleanable.

To replace the element, unscrew the blue bowl counter clockwise by hand. Avoid spilling the product water from the bowl. Remove the Charcoal Filter Element from the bowl and discard. Remove the O-Ring from the bowl and take care to not damage it. Clean the bowl with a mild detergent and rinse out thoroughly.

Wipe the O-Ring with a damp cloth and lubricate it sparingly with O-Ring lubricant and reinstall. Rinse a new HRO CFE Charcoal Filter Element with fresh water to remove the carbon fines from the Element. Insert it into the bowl. Screw the bowl on clockwise. Hand-tighten only enough to seat the O-Ring.

 **CAUTION:** If the O-Ring is missing, not properly seated, or if the bowl is over tightened, leaks develop.

19. **Controller [56]:** The salinity controller does not require any routine maintenance.
20. **UV Ultraviolet Sterilizer [45]:** Follow the preventative maintenance procedures to maximize the efficiency, reliable, and longevity of the UV Sterilizer.

* Refer to Table on Page 8-20 for recommended maintenance schedule.

 **CAUTION!** The most important consideration is operator safety. The following directly relates to operator safety. All personnel must review and comply with the following.

 **CAUTION!** Operators must observe Safety Requirements at all times

Safety Requirements

The following safety requirements are mandatory. Failure to comply can cause injuries and/or damages to the UV unit.

1. Never look directly at the blue ultraviolet lamp when it's "ON". Never operate the ultraviolet lamp outside the stainless steel cabinet. UV light exposure can severely burn and damage eyes and skin.
2. Properly ground the UV unit. Failure to properly ground the UV unit can cause severe electrical shock hazard.
3. Provide watertight piping and compression nut seals. Failure to provide watertight seals can cause damage to electrical components or cause electrical shock hazard.
4. Disconnect power before servicing the UV unit. The UV lamp and electrical components operate with high voltage electrical power. Do not attempt to service the UV unit without first disconnecting the power source. Shut off the source of power at the main panel breaker and use appropriate tag-out or lock-out procedures to prevent accidental power-up.
5. Only qualified service personnel should perform services to the UV unit.
6. Remove pressure before servicing the UV unit.
7. Never operate the UV unit for more than 30 minutes without water flow. Elevated water temperature can damage the UV unit.
8. Do not exceed 3 "Start/Stop" cycles per 24-hour period. Exceeding 3 cycles will subjected the lamp filament to excessive thermal stress leading to premature failure of the UV lamp.

Unit Maintenance: The exterior surfaces of the UV unit should be kept clean and dry. In most cases it may be necessary to clean the exterior of the unit once a month. Use soft cloth and soapy water, or any commercial stainless steel cleaner.

Interior of the ballast box should be inspected for debris. Any debris should be removed using vacuum.

Quartz Sleeve: Debris and other matter in the water will settle onto the quartz sleeve and eventually block the ultraviolet rays from penetrating into the water. It is necessary to determine a cleaning schedule for the quartz sleeve. The frequency will depend on the specific type of water being processed and the duty cycle of the unit.

Inspect the quartz sleeve 30 days after initial installation to assess the amount of contamination collected over the 30-day period. Use the finding to determine a reasonable schedule and frequency for periodic cleaning.

Clean-In-Place (CIP) cleaning is sometimes effective in removing debris from the quartz sleeve. Conduct a CIP cleaning test to determine its effectiveness. If CIP cleaning is not effective, then a manual cleaning or replacement is required.

When the quartz sleeve is due for cleaning, use the following procedures.

1. Turn off the water source to the UV unit.
2. Disconnect the power source to the UV unit.
3. Drain the UV treatment chamber.
4. Remove the ballast box cover.
5. Remove rubber boot and carefully pull out the UV lamp through the compression nut pass-thru.
6. Use a channel lock to remove the compression nuts.
7. Remove the Quartz Sleeve carefully.
8. Wash the Quartz Sleeve with mild soapy water and rinse in clean hot water.

If dirt remains after rinsing, the quartz sleeve should be replaced. Contact your local CSR to order a replacement.



NOTE! Failure to perform quartz sleeve maintenance may reduce the efficiency of the UV light to adequately treat water in the treatment chamber.

Checking for Leaks: Visual inspect the UV unit exterior for signs of leakage. The cause of any leakage must be located and repaired.

If a leakage is detected, perform the following.

1. Shut off all electrical power. Shut off the source of power at the main panel breaker and use appropriate tag-out procedures to prevent accidental power-up.
2. Depressurize the UV unit.
3. Remove ballast box cover and remove the rubber boot.
4. Locate which end of the quartz sleeve is leaking.

Checking for Leaks

Visual inspect the UV unit exterior for signs of leakage. The cause of any leakage must be located and repaired.

If a leakage is detected, perform the following.

1. Shut off all electrical power. Shut off the source of power at the main panel breaker and use appropriate tag-out procedures to prevent accidental power-up.
2. Depressurize the UV unit.
3. Remove ballast box cover and remove the rubber boot.
4. Locate which end of the quartz sleeve is leaking.

Repairing Leaks

If both ends of the quartz sleeve are leaking, perform the following on both ends.

1. Use a channel lock to loosen and remove the compression nut.
2. Remove the quartz sleeve O-ring without pulling the quartz sleeve out.
3. Lubricate the quartz sleeve tip with clean water and place new O-ring. Ensure the O-ring has all-round contact with the cylinder pass-thru.
4. Replace and tighten the compression nut.
5. Refill the treatment chamber and verify a leak-free condition.

Measuring Performance

Every UV unit must be tested periodically to verify its efficiency. Regardless of the intended application or any optional equipment provided with the UV unit, the most accurate procedure is the Post-UV

Analysis. The Post-UV Test must be performed in accordance with standard testing methods.

Verifying Lamp Operation

The UV lamp is "ON" when the blue light is emitting thru the viewport.

Obtaining Water Samples

Vast majority of unsatisfactory Post-UV Test results are directly related to the improper sample-taking techniques. Although several commercial sample collection apparatuses are available, the proper manufacturer's sample procedures must be followed.



NOTE! Sea Recovery recommends a valve with a discharge orifice not to exceed ¼" (6mm).

Sampling Procedure

Use sterile sample bottles obtained from reliable laboratory that has been autoclaved and kept in plastic bag for this procedure.

1. Use temporary tube to direct water from UV unit to container or drainage.
2. Pressurize the UV unit and flush unit with sample valve fully opened for 3.5 minutes. After flushing for 3.5 minutes, reduce valve opening to 50% and flush for 3 minutes.
3. Open the sample bottle and keep the inside of the cap facing down.
4. Fill the sample bottle and avoid breathing directly into the bottle or touching the inside of the bottle, cap, or neck.
5. Immediately cover and secure the cap after filling the sample bottle.
6. Label the sample bottle and place in a clean plastic bag.
7. Take sample bottle to the laboratory for plating as soon as possible.



NOTE! Sample processing must begin within 3 hours after sample collection and must comply with accepted standard methods.

Periodic Maintenance Table

The table below represents the recommended Periodic Maintenance (PM) for the SP Series UV Unit.

Description	Init.	Daily	Mn	Ann.	Other
Quartz Sleeve Cleaning	x				
Quartz Sleeve Replacement*	x				
Operating Condition	x				
Unit Cleaning	x		x		
Leak Inspection	x	x	x		
UV Lamp Inspection	x	x	x		
UV Lamp Replacement-SP-1				x	4,400 hrs
UV Lamp Replacement-SP-2				x	8,000 hrs

* Quartz Sleeve replacement will occur more frequently for systems operating with continuous high flow rate or low water quality water, and less frequently for systems operating with low flow rate or high water quality.

UV Unit Specifications

Type	12 VDC Operating UV Sterilizer for 2 gallon (7.5 liters) per minute of water flow
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Ballast Type	Solid State
Bulb Type	16 Watts Single Ended
Bulb Life	8000 Hours minimum
Materials	Body: SS304; Ballast Box: PVC
Power Cord	13 ft. (4 meters) 2 conductors
Weight	1 lbs. (500g) Body

Temperature Range	Operating: +37°F to +104°F (+3°C to +40°C); Dry Storage: -4°F to +185°F (-25°C to +85°C)
-------------------	--

Operating Voltage Range	10.56V minimum; 16.50V maximum
Current	1.45A maximum @ Standard Test Voltage
UV Dosage	22mJ/cm ² @ 254nm

Operating Pressure	50psi (3.4 bar)
Inlet/Outlet Ports	¼ in. (6.3 mm) NPT Female
Flow Rate	2 gpm (7.5 lpm)
Disinfection Rate	99%

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10

EXPLODED PARTS VIEW

Seafari Versatile 450 - 1800

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10 EXPLODED PARTS VIEW

10.1 WHEN ORDERING

When ordering Parts or Accessories from your local HRO Systems Dealer or from HRO Systems direct, you can save time and ensure that you receive the correct part by providing the following information:

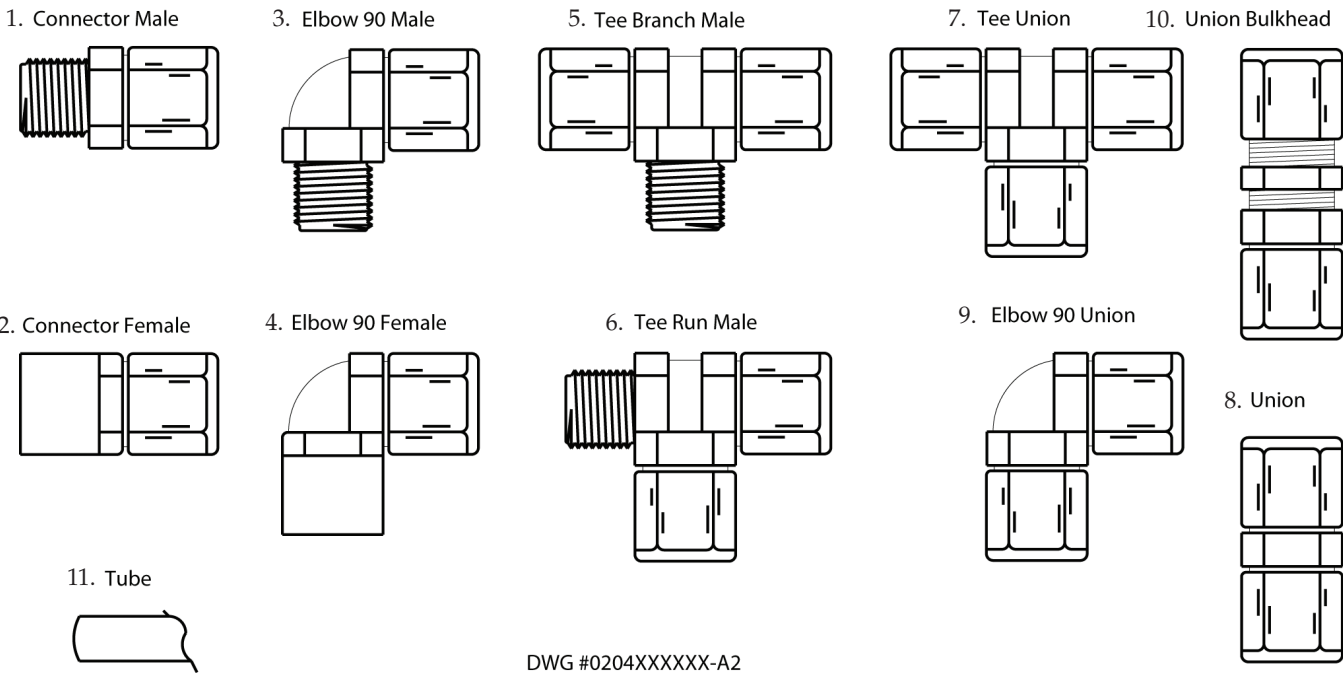
System	System Style	System Production	System Serial #
Seafari	Self Contained / Modular	450-1 (one short 21" (53.3 cm) long R.O. Membrane Element)	Serial Number
Seafari	Self Contained / Modular	700-1 (one medium 31" (78.7 cm) long R.O. Membrane Element)	Serial Number
Seafari	Self Contained / Modular	900-1 (one long 40" (101.6 cm) long R.O. Membrane Element)	Serial Number
Seafari	Self Contained / Modular	900-2 (two short 21" (53.3 cm)" long R.O. Membrane Element)	Serial Number
Seafari	Self Contained / Modular	1400-2 (two medium 31" long R.O. Membrane Element)	Serial Number
Seafari	Self Contained / Modular	1800-2 (two long 40" long R.O. Membrane Element)	Serial Number

Provide us with information on the part that you wish to order:

Part Number Part Description Quantity

Having this information will expedite your request and ensure that you receive the correct part.

10.2 AVAILABLE TUBES AND FITTINGS



DWG #0204XXXXXX-A2

PART NO	DESCRIPTION
1. CONNECTOR MALE	
0204090669	1/4 inch tube x 1/8 inch mnpt
0204090869	1/4 inch tube x 1/4 inch mnpt
0204091669	3/8 inch tube x 1/8 inch mnpt
0204091769	3/8 inch tube x 1/4 inch mnpt
0204091869	3/8 inch tube x 3/8 inch mnpt
0204091969	3/8 inch tube x 1/2 inch mnpt
0204092069	3/8 inch tube x 3/4 inch mnpt
0204092269	1/2 inch tube x 1/8 inch mnpt
0204092369	1/2 inch tube x 1/4 inch mnpt
0204092469	1/2 inch tube x 3/8 inch mnpt
0204092569	1/2 inch tube x 1/2 inch mnpt
0204092669	1/2 inch tube x 3/4 inch mnpt
0204099069	5/8 inch tube x 1/8 inch mnpt
0204099169	5/8 inch tube x 1/4 inch mnpt
0204092869	5/8 inch tube x 3/8 inch mnpt
0204092969	5/8 inch tube x 1/2 inch mnpt
0204093169	5/8 inch tube x 3/4 inch mnpt
2. CONNECTOR FEMALE	
0204120669	1/4 inch tube x 1/8 inch fnpt
0204120869	1/4 inch tube x 1/4 inch fnpt
0204121769	3/8 inch tube x 1/4 inch fnpt
0204121869	3/8 inch tube x 3/8 inch fnpt
0204121969	3/8 inch tube x 1/2 inch fnpt
0204122569	1/2 inch tube x 1/2 inch fnpt
0204122669	1/2 inch tube x 3/4 inch fnpt
0204122969	5/8 inch tube x 1/2 inch fnpt

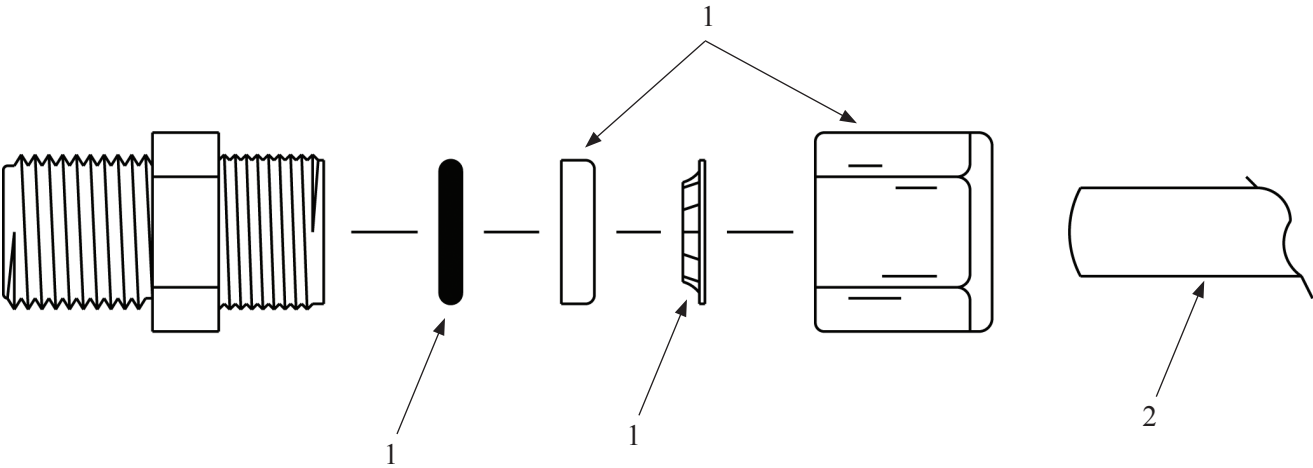
PART NO.	DESCRIPTION
3. ELBOW 90 MALE	
0204020669	1/4 inch tube x 1/8 inch mnpt
0204020869	1/4 inch tube x 1/4 inch mnpt
0204020969	1/4 inch tube x 3/8 inch mnpt
0204021769	3/8 inch tube x 1/4 inch mnpt
0204021869	3/8 inch tube x 3/8 inch mnpt
0204021969	3/8 inch tube x 1/2 inch mnpt
0204022069	3/8 inch tube x 3/4 inch mnpt
0204022469	1/2 inch tube x 3/8 inch mnpt
0204022569	1/2 inch tube x 1/2 inch mnpt
0204022969	5/8 inch tube x 1/2 inch mnpt
4. ELBOW 90 FEMALE	
0204010669	1/4 inch tube x 1/8 inch fnpt
0204010869	1/4 inch tube x 1/4 inch fnpt
0204011769	3/8 inch tube x 1/4 inch fnpt
0204011869	3/8 inch tube x 3/8 inch fnpt
0204012469	1/2 inch tube x 3/8 inch fnpt
0204012569	1/2 inch tube x 1/2 inch fnpt
0204012969	5/8 inch tube x 1/2 inch fnpt
5. BRANCH TEE MALE	
0204150669	1/4 inch tube x 1/8 inch mnpt
0204151769	3/8 inch tube x 1/4 inch mnpt
0204152469	1/2 inch tube x 3/8 inch mnpt
0204152969	5/8 inch tube x 1/2 inch mnpt

Continued on next page (10-4)

AVAILABLE TUBE COMPRESSION FITTINGS CONTINUED

PART NO.	DESCRIPTION
6. RUN TEE MALE	
0204170669	1/4 inch tube x 1/8 inch mnpt
0204170869	1/4 inch tube x 1/4 inch mnpt
0204171769	3/8 inch tube x 1/4 inch mnpt
0204171869	3/8 inch tube x 3/8 inch mnpt
0204172469	1/2 inch tube x 3/8 inch mnpt
0204172569	1/2 inch tube x 1/2 inch mnpt
0204172969	5/8 inch tube x 1/2 inch mnpt
7. UNION TEE	
0204240869	1/4 inch tube
0204241869	3/8 inch tube
0204242469	1/2 inch tube x 3/8 inch tube
0204242569	1/2 inch tube
0204242869	5/8 inch tube x 3/8 inch tube
0204243069	5/8 inch tube
8. UNION	
0204210869	1/4 inch tube
0204211769	3/8 inch tube x 1/4 inch tube
0204211869	3/8 inch tube
0204212469	1/2 inch tube x 3/8 inch tube
0204212569	1/2 inch tube
0204212869	5/8 inch tube x 3/8 inch tube
0204212969	5/8 inch tube x 1/2 inch tube
0204213069	5/8 inch tube
9. UNION ELBOW 90	
0204220869	1/4 inch tube
0204221769	3/8 inch tube x 1/4 inch tube
0204221869	3/8 inch tube
0204222569	1/2 inch tube
0204223069	5/8 inch tube
10. UNION BULKHEAD	
0204270869	1/4 inch tube
0204271869	3/8 inch tube
0204272569	1/2 inch tube
11. TUBE	
0312122969	1/4 inch tube Black Nylon
0306152969	1/4 inch tube Blue Polypropylene
0306142969	1/4 inch tube Red Polypropylene
0312124169	3/8 inch tube Black Nylon
0306154169	3/8 inch tube Blue Polypropylene
0306144169	3/8 inch tube Red Polypropylene
0312125069	1/2 inch tube Black Nylon
0305125869	5/8 inch tube Black Polypropylene

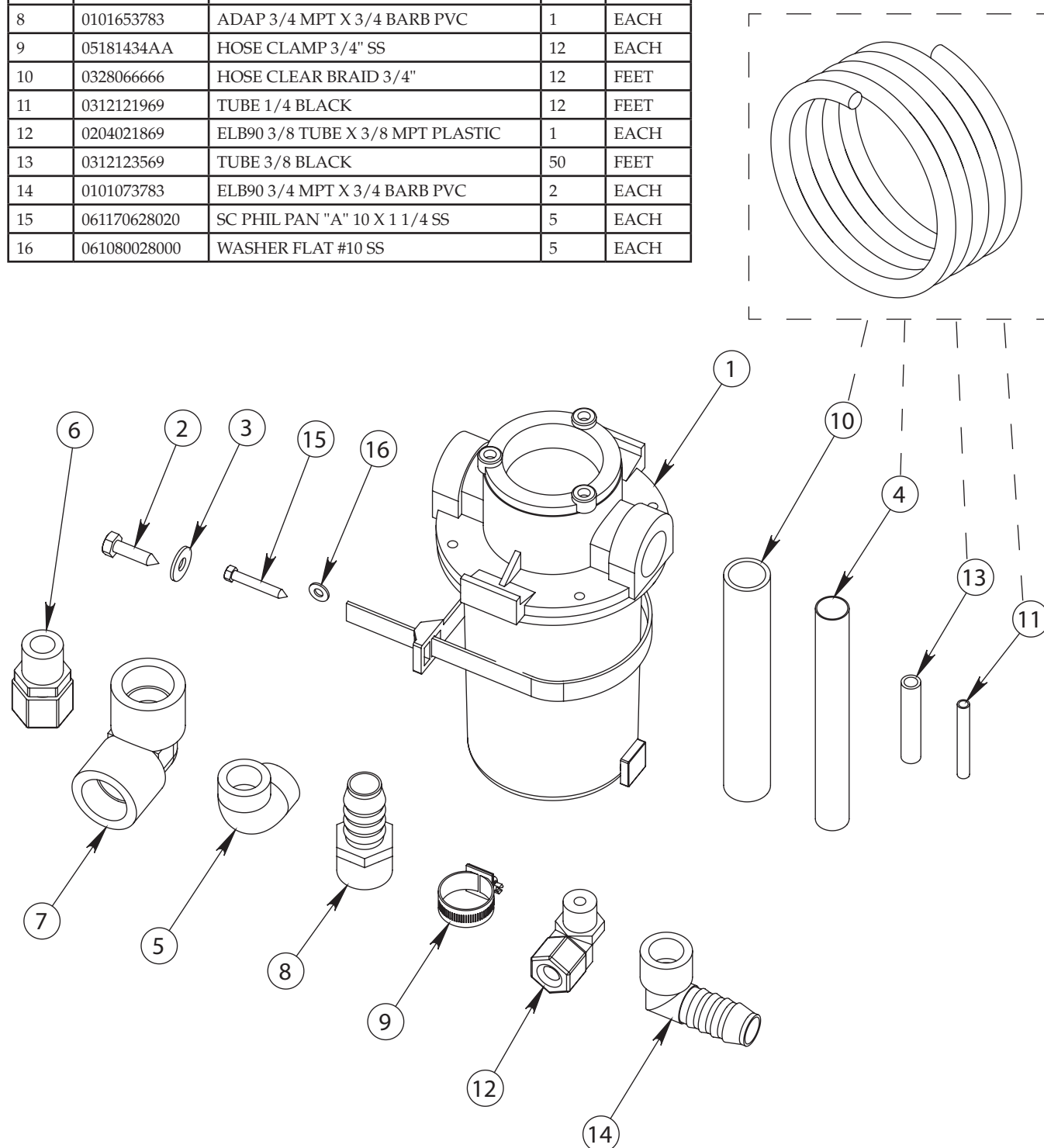
TUBE COMPRESSION FITTINGS REPLACEMENT PARTS



ITEM	DESCRIPTION	PART NO.
FOR 1/4" O.D. TUBE		
1	NUT/SPACER/GRAB & O-RING 1/4"	0204-1/469
2	TUBE 1/4 BLACK	0312121969
FOR 3/8" O.D. TUBE		
1	NUT/SPACER/GRAB & O-RING 3/8"	0204-3/869
2	TUBE 3/8 BLACK	0312123569
FOR 1/2" O.D. TUBE		
1	NUT/SPACE/GRAB & O-RING 1/2"	0204-1/269
2	TUBE 1/2 BLACK NO SUBSTITUTE	0312124269
FOR 5/8" O.D. TUBE		
1	NUT/SPACER/GRAB & O-RING 5/8"	0204-5/869
2	TUBE 5/8 BLACK POLYPRO	0305125169

10.3 INSTALLATION KIT - HORIZON SEAFARI B2001210001

ITEM	PART NO	DESCRIPTION	QTY	UM
1	0421051239	SEA STRAINER-3/4 BRONZE	1	EACH
2	061172143016	SC HEX "A" 1/4 X 1 SS	8	EACH
3	061100043000	WASHER FLAT OS 1/4"SS	8	EACH
4	0312124269	TUBE 1/2 BLACK NO SUBSTITUTE	20	FEET
5	0101012583	ELB90 1/2 FPT X 1/2 FPT PVC	1	EACH
6	0204092569	CONN 1/2 TUBE X 1/2 MNPT PLASTIC	1	EACH
7	0101013783	ELB90 3/4 FPT X 3/4 FPT PVC	1	EACH
8	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC	1	EACH
9	05181434AA	HOSE CLAMP 3/4" SS	12	EACH
10	0328066666	HOSE CLEAR BRAID 3/4"	12	FEET
11	0312121969	TUBE 1/4 BLACK	12	FEET
12	0204021869	ELB90 3/8 TUBE X 3/8 MPT PLASTIC	1	EACH
13	0312123569	TUBE 3/8 BLACK	50	FEET
14	0101073783	ELB90 3/4 MPT X 3/4 BARB PVC	2	EACH
15	061170628020	SC PHIL PAN "A" 10 X 1 1/4 SS	5	EACH
16	061080028000	WASHER FLAT #10 SS	5	EACH



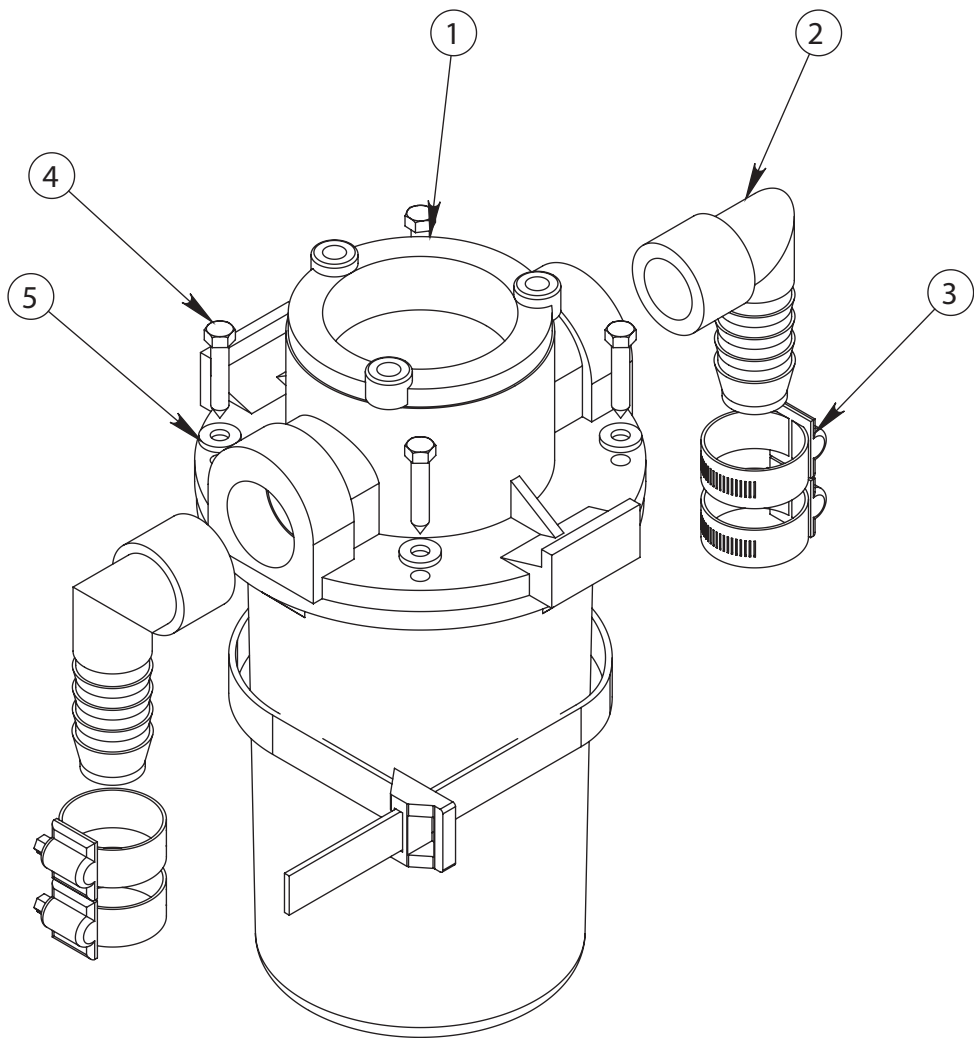
10.4 MAJOR PARTS

1. SEA STRAINER ASSY COMMERCIAL H2006210002

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	0421051239	SEA STRAINER ASSY .75 BRONZE	1	EACH
2	01120737DG	ELBO90 MNPT X 3/4 BARB NYLON	2	EACH
3	05181434AA	HOSE CLAMP 3/4" SS	4	EACH
4	061170628016	SC PHIL PAN "A" 10 X 1 SS	5	EACH
5	065080028000	WASHER FLAT #10 NYLON	5	EACH

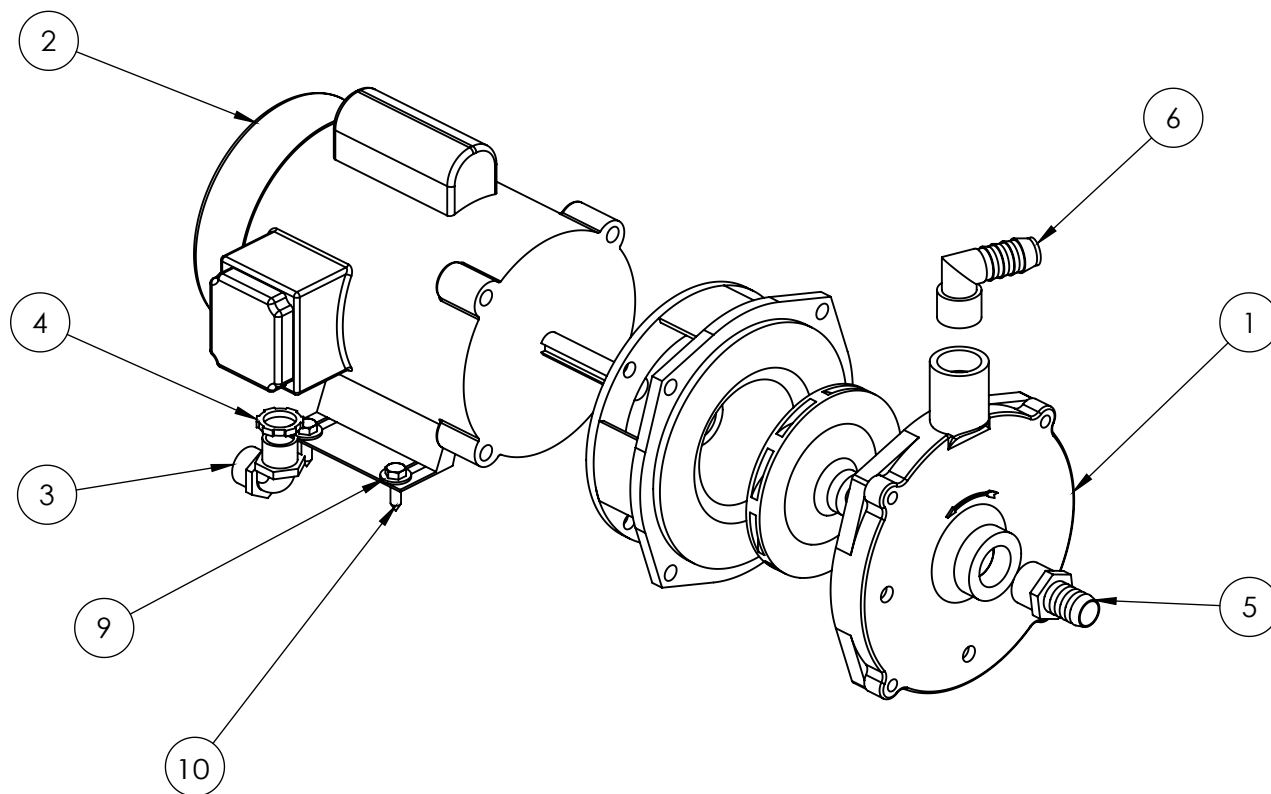
RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
0421051239 -2	SEA STRAINER-BRONZE O-RING
0421051239-4	SEA STRAINER-BRONZE O-RING BOW
0421051239-6	MESH SCREEN-BRONZE 3/4 MONEL
0421051239-7	MESH SCREEN-BRONZE 3/4 NON-ME



2. BOOSTER PUMP MOTOR ASSY 1PH HP75 - B016080026

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	1205514772	BOOSTER PUMP HEAD HP75 SS	1	EACH
2	1519081110	MOTOR .50 HP 110-230-50-60-1PH	1	EACH
3	1920023632	STRAIN RELIEF 90 CG90-6250	1	EACH
4	063200066000	NUT LOCK 1/2" STEEL	1	EACH
5	0112653700	ADAP 3/4 MPT X 3/4 BARB NYLON	1	EACH
6	01120737DG	ELB90 MNPT X 3/4 BARB NYLON	1	EACH
7	3131210495	WIRE NUT YELLOW	2	EACH
8	31313849CD	TERMINAL CONN AW 22-12 GAUGE	1	EACH
9	061100043000	WASHER FLAT OS 1/4"SS	4	EACH
10	061172143016	SC HEX "A" 1/4 X 1 SS	4	EACH



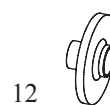
MAINTENANCE SEAL KIT

B655800009



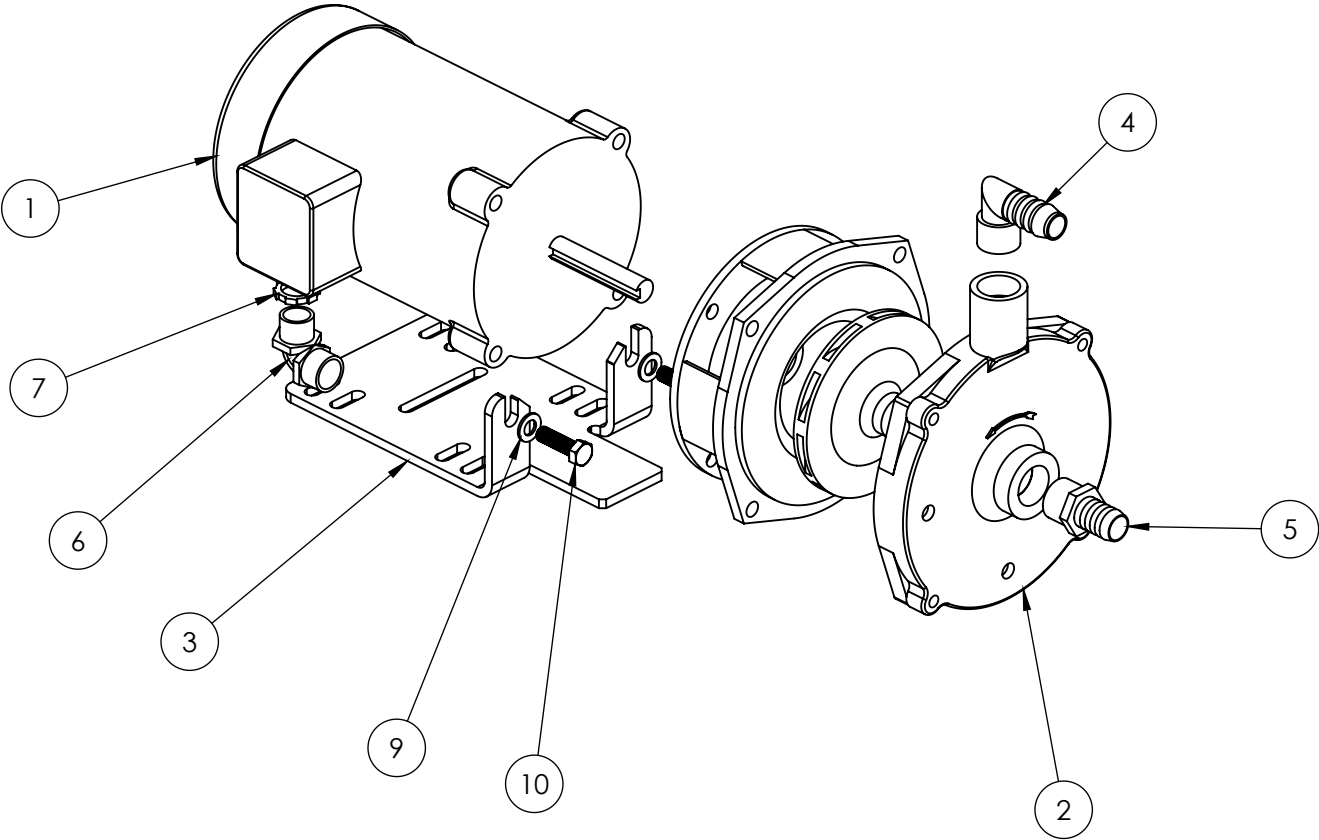
MAINTENANCE IMPELLER KIT

291211181PP



3. BOOSTER PUMP ASSY MOTOR ASSY 3 PH HP75 - B016080027

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	1520181110	MOTOR .50 HP 208-230-460-50-60	1	EACH
2	1205514772	BOOSTER PUMP HEAD HP75 SS	1	EACH
3	01221514722-3	BOOSTER PUMP BRACKET	1	EACH
4	01120737DG	ELB90 MNPT X 3/4 BARB NYLON	1	EACH
5	0112653700	ADAP 3/4 MPT X 3/4 BARB NYLON	1	EACH
6	1920023632	STRAIN RELIEF 90 CG90-6250	1	EACH
7	063200066000	NUT LOCK 1/2" STEEL	1	EACH
8	3131210495	WIRE NUT YELLOW	4	EACH
9	061100056000	WASHER FLAT OS 3/8 SS	2	EACH
10	061142157020	BOLT HEX 3/8-16 X 1 1/4" SS	2	EACH



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PRE-FILTRATION CARTRIDGE FILTER ELEMENT WARNING:

Do not use third party Pre-filtration Elements (Plankton Filter Elements, Prefilter Elements, Commercial Prefilter Elements, or Oil/Water Separator Elements). Use only HRO Systems supplied Pre-filtration Elements. Third party pre-filtration elements on the market do not properly fit into the HRO Systems Filter Housings, the seams fall apart, and they will allow by-pass resulting in EXTENSIVE AND EXPENSIVE DAMAGE TO THE HIGH PRESSURE PUMP AS WELL AS PREMATURE FOULING OF THE R.O. MEMBRANE ELEMENT.

Damage caused to the HRO Systems High Pressure Pump, R.O. Membrane Element, or any other component from the use of third party, non HRO Systems supplied, filter elements is the responsibility and liability of the operator and is not covered by the HRO Systems Warranty.



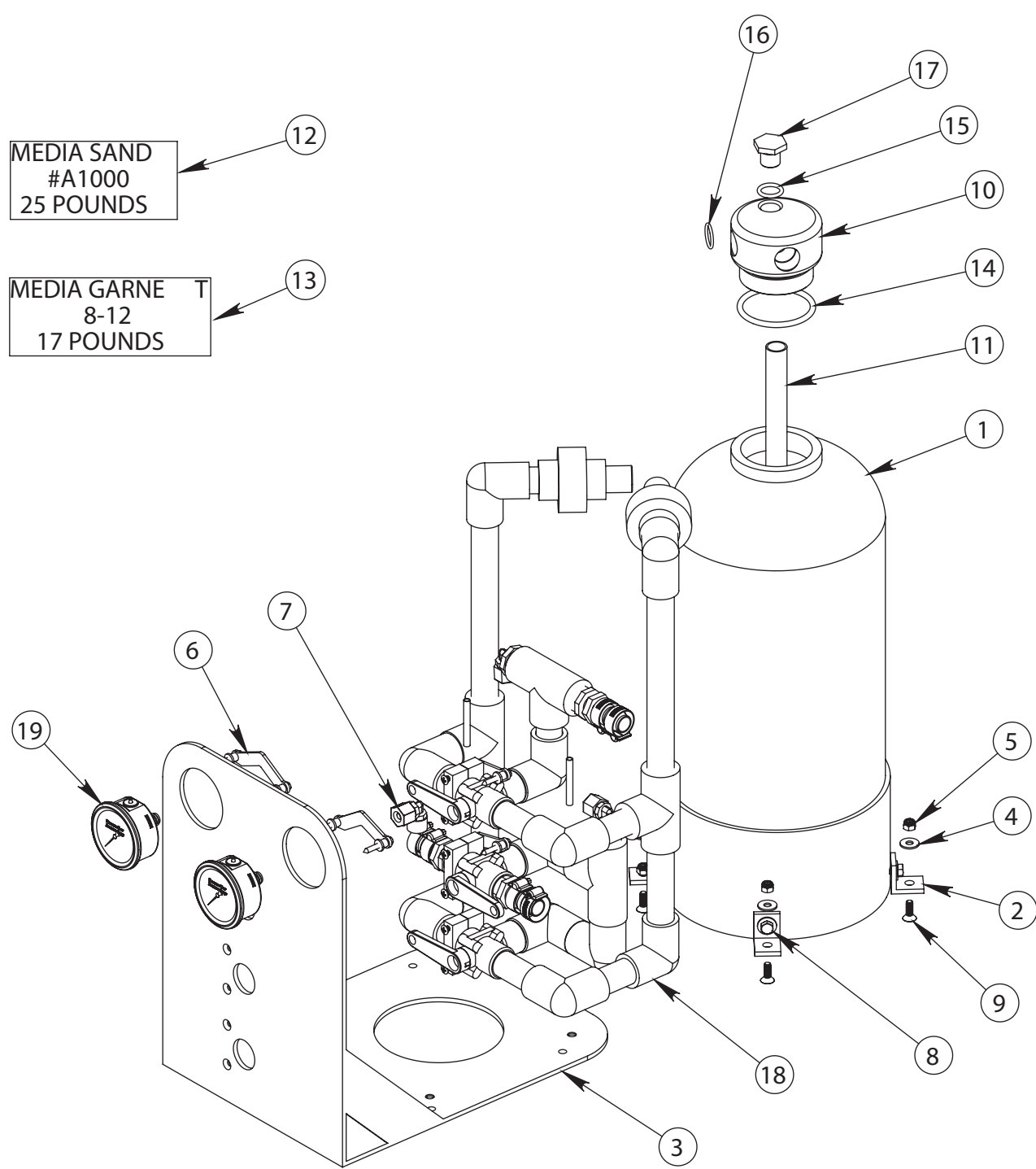
FILTER ELEMENT CAUTION:

Do not use "string wound" or "fiber" type prefilter elements. These type of elements are designed for the Photographic Film Developing industry. When used in sea water they will plug up rapidly in 1/10th or less the time causing frequent shut down of the system and very frequent changing resulting in very high cost of maintenance.

5. MEDIA FILTER ASSY -4 HS/AW/UW B071080002

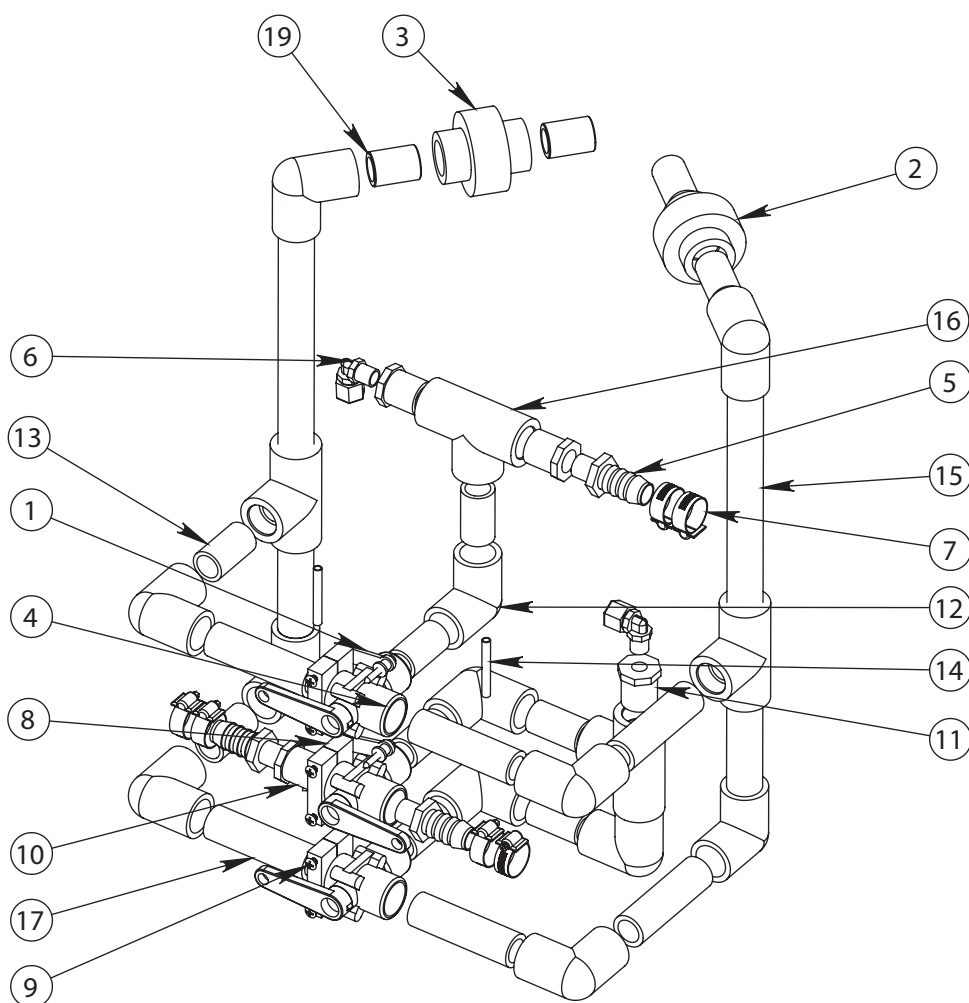
TEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	0708040468-1	MEDIA FILTER HOUSING 818 ALMOND	1	EA
2	20200404010	BRACKET ""L"" MOUNTING FEET	4	EA
3	20200325000	SKID MEDIA FILTER AS>7/97	1	EA
4	061100043000	WASHER FLAT OS 1/4"SS	16	EA
5	061060045000	NUT HEX 1/4-20 W/INSERT SS	8	EA
6	05180851CC	GAUGE BRACKET CBM SS	2	EA
7	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLAST	2	EA
8	061142145012	BOLT HEX 1/4-20 X 3/4 SS	4	EA
9	061161845012	SC ALLEN FLAT 1/4-20 X 3/4 SS	4	EA
10	0708040400-1	MEDIA FILTER TOP	1	EA
11	0708040400-2	MEDIA FILTER RISER	1	EA
12	4643020255	MEDIA SAND A1000 (100LB BAG)	25	LB.
13	4643070155	MEDIA GARNET 8-12 50# BAG	17	LB.
14	2614017300	O-RING 334 MEDIA LID 97	1	EA
15	2614013001	O-RING 209	1	EA
16	2614017400	O-RING 117 MEDIA TOP INLET	1	EA
17	0708040400-3	PLUG MEDIA FILTER TOP	1	EA
18	B075000001	MULTI MEDIA FILTER PLUMBING	1	EA
19	10181522CC	GAUGE -30/0/70 CBM.NPT	2	EA

Refer to illustration on next page



6. MULTI MEDIA FILTER PLUMBING ASSY B075000001

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	05180851CC	GAUGE BRACKET CBM SS	2	EA
2	0101693783	UNION .75 SL x .75 SL PVC	1	EA
3	0101673783	UNION .75 FNPT x .75 FNPT PVC	1	EA
4	14011317AR	VALVE 3-WAY BALL .75 SL	3	EA
5	0101652683	ADAP 1/2 MPT X 3/4 BARB PVC	3	EA
6	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLAST	2	EA
7	05181434AA	HOSE CLAMP 3/4" SS	6	EA
8	1453131700-02	VALVE BRACKET 3/4" SL, SET	3	EA
9	061161130028	SC PHIL OVAL 10-24 X 1 1/4 SS	6	EA
10	0101313683	RB .75 SL x .50 FNPT PVC	3	EA </td
11	0101323483	RB .75 SL x .25 FNPT PVC	2	EA
12	0101053783	ELB90 .75 SL X .75 SL PVC	12	EA
13	0301096600	PIPE PVC SCH 80 .75 DIA x 1.75LG	5	FT
14	0312121969	TUBE .25 BLK SEMI-RIGID NYLON	2	EA
15	0301096600	PIPE PVC SCH 80 3/4" PER FOOT	2	EA
16	0101463783	TEE .75 SL x .75 SL x .75 SL PVC	4	EA
17	0301096600	PIPE PVC SCH 80 .75 DIA x 3.625LG	5	FT
18	0328066666	HOSE CLEAR BRAID 3/4"	15	FT
19	01013737CL	NIPPLE .75 NPT X CLOSE PVC	2	EA

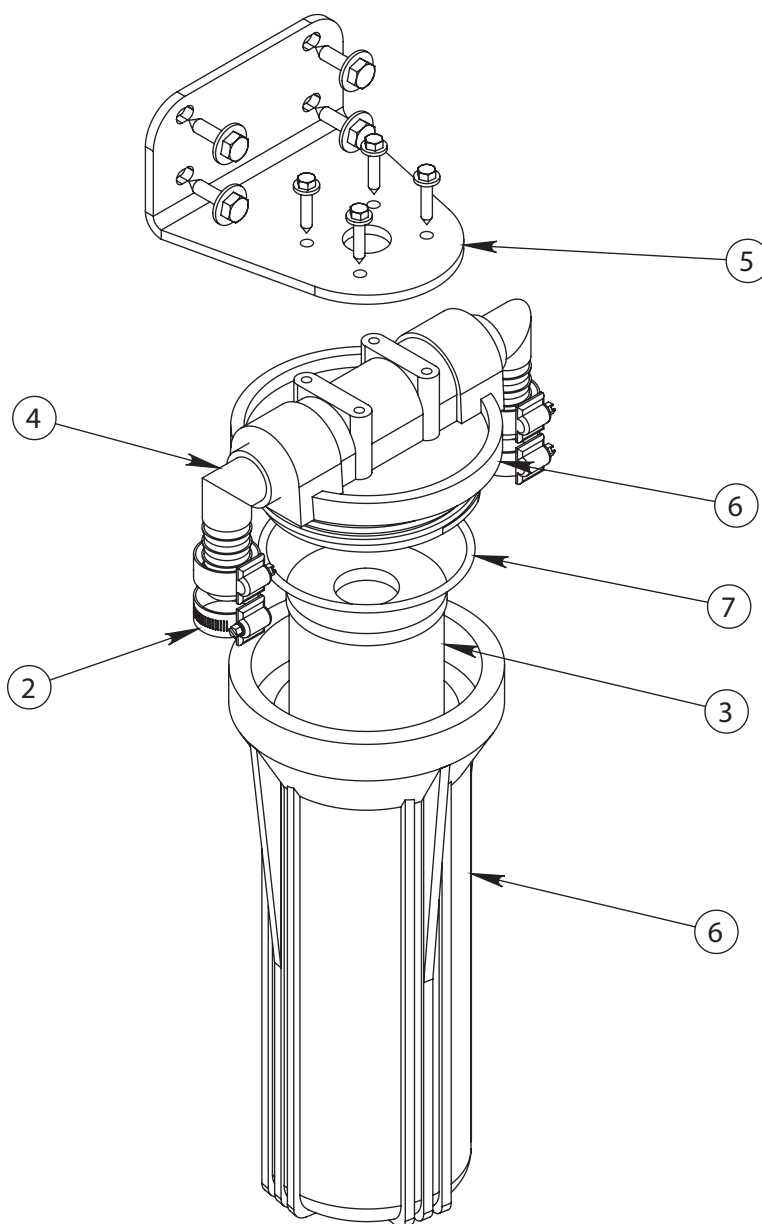


7. PLANKTON FILTER ASSY-SINGLE B008800001

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	05181434AA	HOSE CLAMP 3/4" SS	4	EA
2	0805823578	ELEMENT PLANKTON	1	EA
3	0101073783	ELB90 3/4 MNPT X 3/4 BARB PVC	2	EA
4	20200402102	SINGLE FILTER BRACKET	1	EA
5	0713020473	FILTER HOUSING-LID 3/4 X 10 ASM	1	EA
6	061172143016	SC HEX "A" 1/4 X 1 SS	4	EA
7	061100043000	WASHER FLAT OS 1/4" SS	4	EA
8	061170628016	SC PHIL PAN "A" 10 X 1 SS	4	EA
9	065080028000	WASHER FLAT #10 NYLON	4	EA

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
2614010473	O-RING 237 BLUE HOUSING

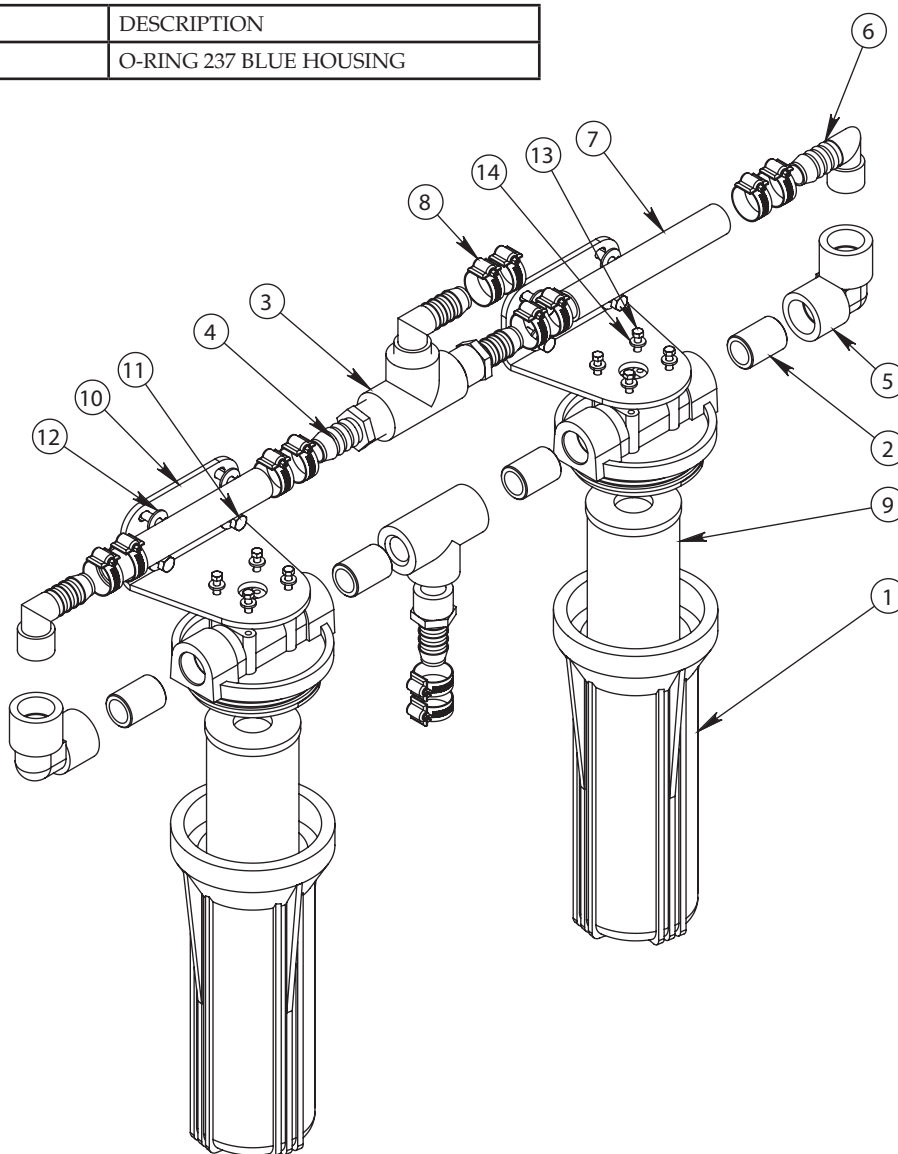


8. PLANKTON FILTER ASSY-DOUBLE B008800002

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	0713020473	FILTER HOUSING/LID 3/4 X 10	2	EA
2	01013737CL	NIPPLE 3/4 NPT X CLOSE PVC "S	4	EA
3	0101423783	TEE 3/4 FT x 3/4 FT x 3/4 FT P	2	EA
4	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC	3	EA
5	0101013783	ELB90 3/4 FPT X 3/4 FPT PVC	2	EA
6	0101073783	ELB90 3/4 MPT X 3/4 BARB PVC	3	EA
7	0328066666	HOSE CLEAR BRAID 3/4"	2	EA
8	05181434AA	HOSE CLAMP 3/4" SS	12	EA
9	0805823578	ELEMENT PLANKTON	2	EA
10	20200402102	BRACKET SINGLE FILTER	2	EA
11	061172143016	SC HEX "A" 1/4 X 1 SS	8	EA
12	061100043000	WASHER FLAT OS 1/4"SS	8	EA
13	061170628016	SC PHIL PAN "A" 10 X 1 SS	8	EA
14	065080028000	WASHER FLAT #10 NYLON	8	EA

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
2614010473	O-RING 237 BLUE HOUSING

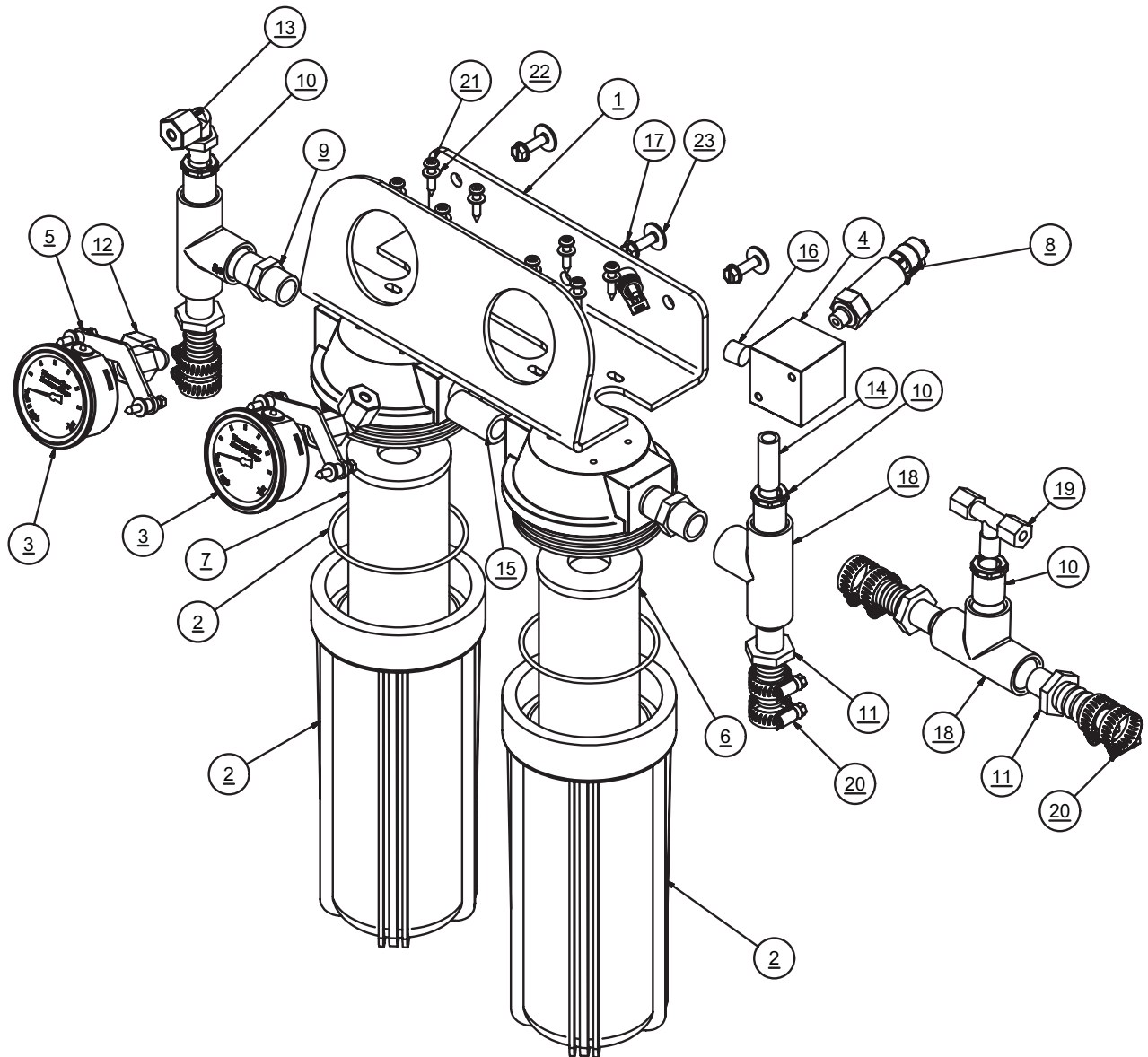


9. PREFILTER ASSY W/GAUGE HORIZON SEAFARI H2108200002

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	H31740040001	BRACKET DELUXE DUAL PREFILTER	1
2	0713020873	FILTER HOUSING .50 X 10	2
3	10181522CC	GAUGE -30-0-70 CBM.NPT	2
4	5333220901	MANIFOLD LP AW 170	1
5	05180851CC	BRACKET,GAUGE,CBM,SS	2
6	0801060157	ELEMENT PREFILTER 10-05	1
7	0801130257	ELEMENT PREFILTER 10-25	1
8	2317100200	TRANSDUCER 0-200 PSI .437 SAE	1
9	01123738DG	NIPPLE HEX .5 MPT X .5 MPT NY	2
10	01122923DG	RB 0.50 MPT x 0.25 FT NYL	3
11	01126526DG	ADAP .5 MPT X .75 BARB NYLON	4
12	0204010869	ELBOW,PP,1/4 ODx1/4 FT	2
13	0204020869	ELBOW,PP,1/4 ODx1/4 MT	1
14	0101370815	NIPPLE 0.25 NPT x 1.50	1
15	0101372515	NIPPLE 0.50 NPT x 1.50	1
16	0117340800	PLUG SOC ,0.25 MT SS	1
17	061172143016	SCREX,HEX A,,25x1.00,SS	3
18	01124225DG	TEE 0.50 FT x FT x FT NYL	3
19	0204170869	TEE,BRANCH,PP,1-4 ODx1-4 MTx 1-4 OD	1
20	05181434AA	CLAMP,HOSE,SS,3/4"	8
21	061170628016	SC PHIL PAN A #10 X 1 SS	8
22	061080028000	WASHER FLAT #10 SS	8
23	061100043000	WASHER FLAT OS .25 SS	3

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
2614010473	O-RING 237 BLUE HOUSING

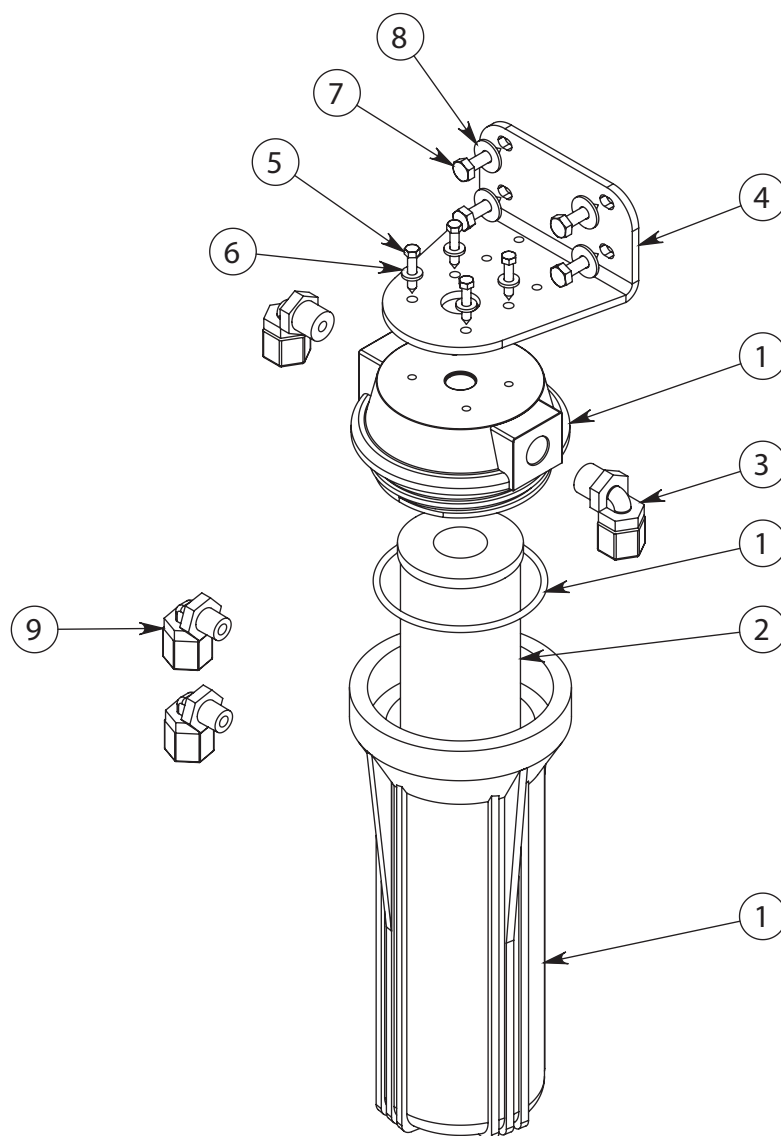


10. CHARCOAL FILTER ASSY HORIZON SEAFARI H2521210001

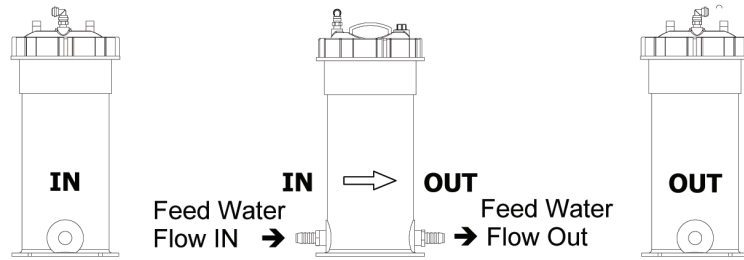
ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	0713020573	FILTER HOUSING/LID 3/8 X 10	1
2	0803004773	ELEMENT CHARCOAL 10"	1
3	0204021869	ELB90 3/8 TUBE X 3/8 MPT PLASTIC	2
4	20200402102	BRACKET SINGLE FILTER	1
5	061170628016	SC PHIL PAN "A" 10 X 1 SS	4
6	065080028000	WASHER FLAT #10 NYLON	4
7	061172143016	SC HEX "A" 1/4 X 1 SS	4
8	061100043000	WASHER FLAT OS 1/4"SS	4
9	0204020969	ELB90 1/4 TUBE X 3/8 MPT PLAST	2

RECOMMENDED SPARES

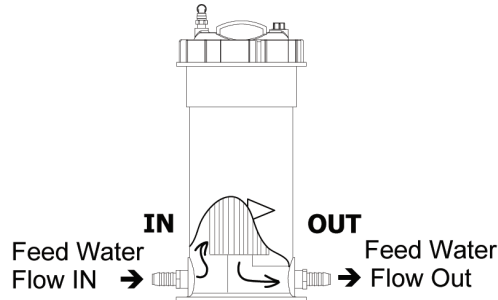
PART NUMBER	DESCRIPTION
2614010473	O-RING 237 BLUE HOUSING



COMMERCIAL PREFILTER CONNECTION AND WATER FLOW

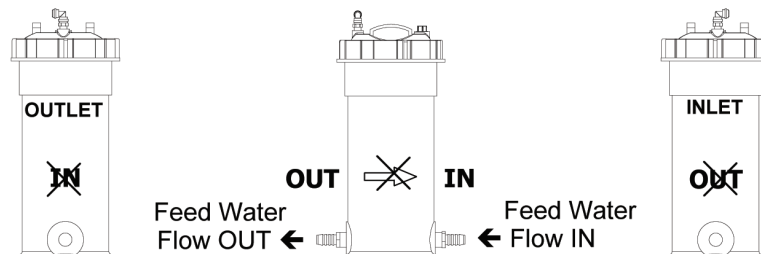


Commercial Prefilter is plumbed
as per the raised arrows and markings IN and OUT

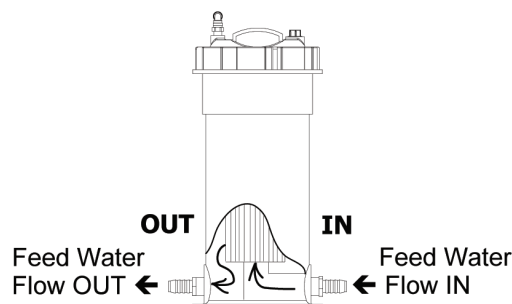


Feed Water Flow through the Commercial
Prefilter Element is from the OUTSIDE
of the Element to the INSIDE CENTER
of the Element

OIL/WATER SEPARATOR CONNECTION AND WATER FLOW



Oil/Water Separator utilizes the same housing as the Commercial Prefilter, however it is plumbed
OPPOSITE of the Commercial Prefilter and OPPOSITE of the raised arrows and markings IN and OUT
Separate Labels are placed on the Oil/Water Separator indicating correct INLET and OUTLET



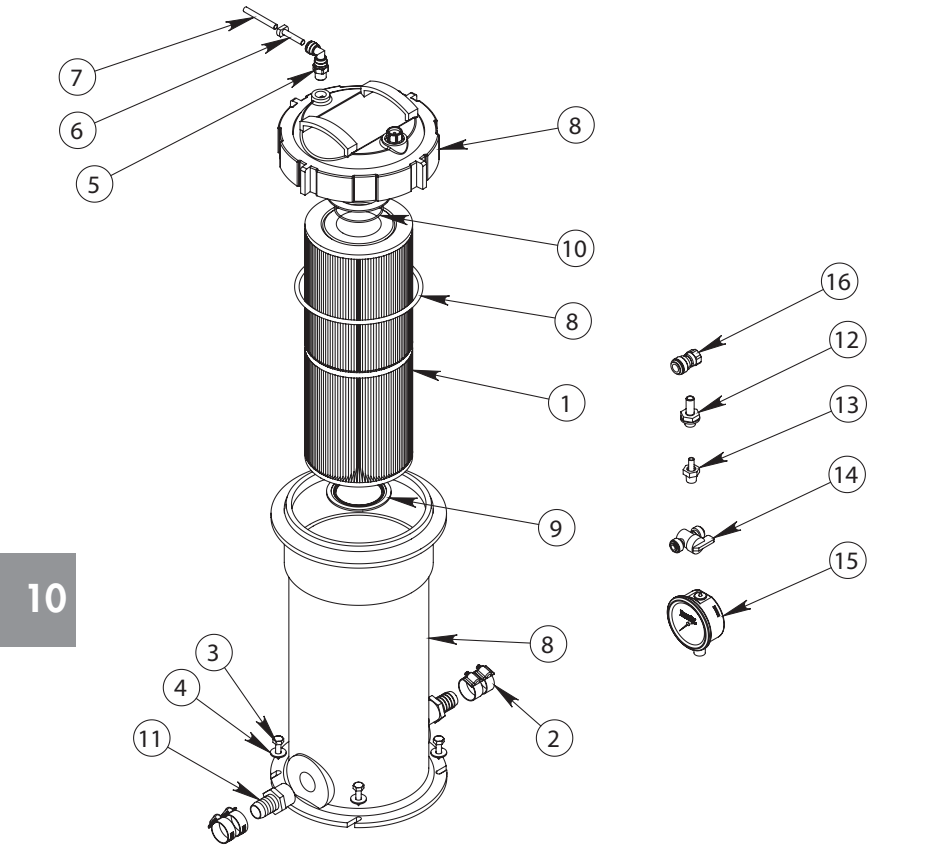
Feed Water Flow through the
Oil/Water Separator Element
is from the INSIDE CENTER
of the Element to the
OUTSIDE of the element

11. COMMERCIAL PREFILTER ASSY 32.5 SQ FT HRO HS B109120002

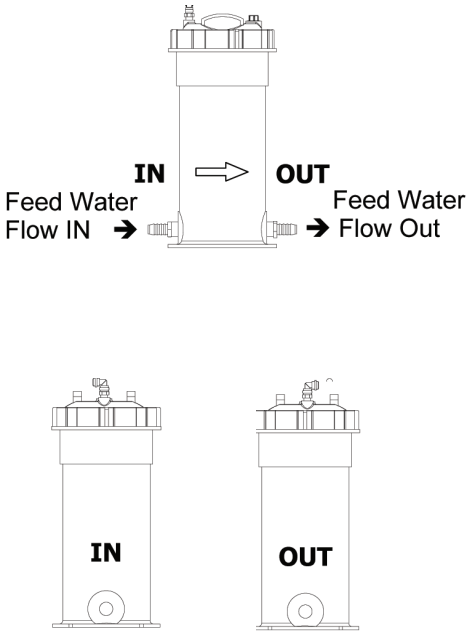
ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	0801063357	ELEMENT CPFE 5 MIC 32.5 SQFT	1	EA
2	05181434AA	HOSE CLAMP 3/4" SS	4	EA
3	061172143016	SC HEX "A" 1/4 X 1 SS	4	EA
4	061100043000	WASHER FLAT OS 1/4"SS	4	EA
5	0204020100	ELB90 1/4 TUBE JG X 1/4 MNPT	1	EA
6	0204990300	PLUG 1/4 JG	1	EA
7	0312121969	TUBE 1/4 BLACK	15	FT
8	07620310WA	FILTER HOUSING 32.5SQFT >10/01	1	EA
9	3901040100	ADAPTER SPACER RING PVC	2	EA
10	2614018969	O-RING 2-034 ADAPTER SPACER	2	EA
11	0112653700	ADAP 3/4 MPT X 3/4 BARB NYLON	2	EA
12	0204090300	ADAPTER 3/8 X 1/4 BSP JG QUIK	1	EA
13	0204090400	ADAPTER 1/4 X 1/4 BSP JG QUIK	1	EA
14	1404553800	VALVE AIR BLEED 1/4TU X 1/4TU	1	EA
15	10180103CC	GAUGE -30/0/70 BPM.NPT	1	EA
16	0204092070	CONN 3/8" TUBE X 1/4" FNPT	1	EA

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
07620310WA-06	O-RING LID CPF/OWS 32.5 SQFT



Commercial Prefilter
Connection and Water Flow



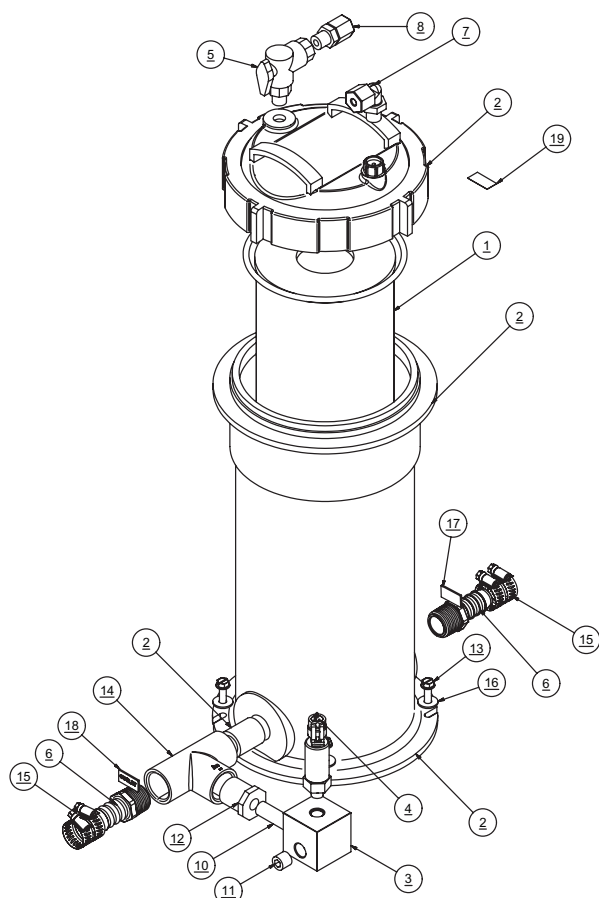
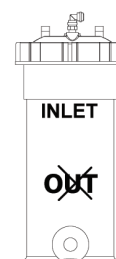
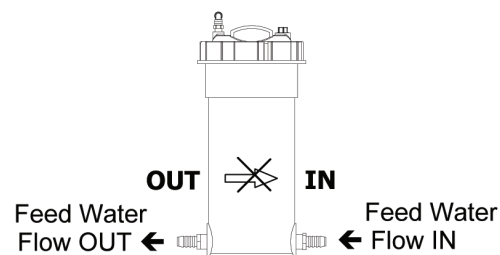
Commercial Prefilter is plumbed as per
raised arrows and markings IN and OUT

12. OIL WATER SEPARATOR 32.5 SQ FT HORIZON SEAFARI B111800006

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	08020723KD	ELEMENT OWSE 32.5 SQFT	1	EA
2	07620310WA	FILTER HOUSING 32.5 SQFT	1	EA
3	5333220901	MANIFOLD LP AW 170	1	EA
4	2317100200	TRANSDUCER 0-200 PSI .437 SAE	1	EA
5	14015506AR-02	VALVE BALL .25 FTx MT	1	EA
6	0112653700	ADAP .75 MPT X.75 BARB NYLON	2	EA
7	0204020869	ELBOW,PP,1/4 ODx1/4 MT	1	EA
8	0204090869	FITTING,PP,1/4 ODx1/4 MT	1	EA
9	01123737DG	NIP 0.75 NPT X 0.75 NPT NYLON	1	EA
10	00101370815	NNIPPLE 0.25 NPT x 1.50	1	EA
11	00117340800	PLUG SOC ,0.25 MT SS	1	EA
12	01122934DG	RB .75 MPT X .25 FNPT NYLON	1	FT
13	061172143016	SCREX,HEX A,.25x1.00,SS	4	EA
14	01124237DG	TEE 0.75 FPT X FPT X FPT NYLON	1	EA
15	205181434AA	CLAMP,HOSE,SS,3/4"	4	EA
16	2061100043000	WASHER,FLAT,OS,1/4",SS	4	EA
17	22213017063	LABEL INLET (WHITE BACKGROUND)	1	EA
18	2213017163	LABEL OUTLET (WHITE BACKGROUND)	1	EA
19	22130101BE	LABEL OIL WATER SEPERATOR	1	EA

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
07620310WA-06	O-RING LID CPF/OWS 32.5 SQFT

Oil Water Separator
Connection and Water Flow

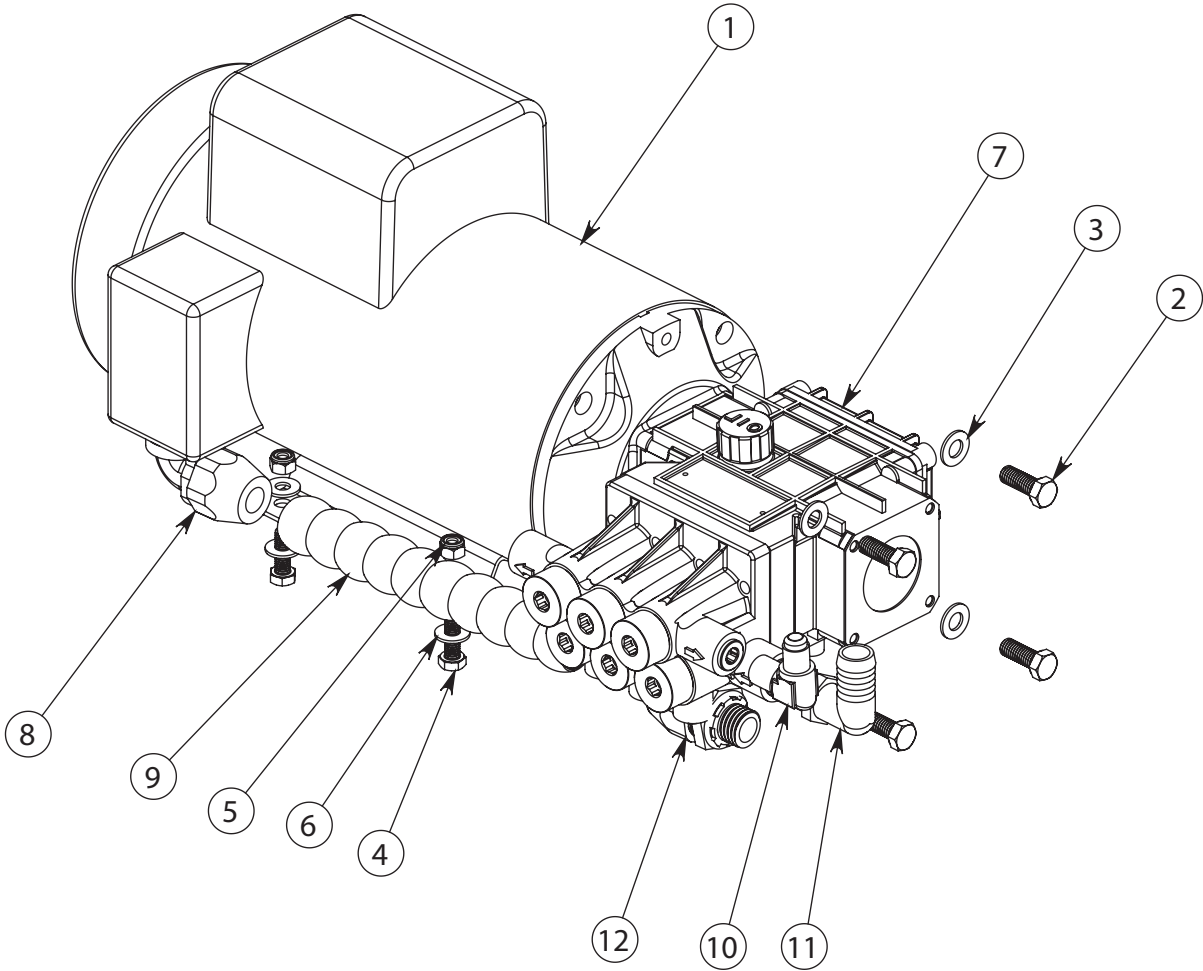
Oil Water Separator uses the same housing as the Commercial Prefilter, however it is plumbed **OPPOSITE** of the Commercial Prefilter. **DO NOT** follow the raised arrows and markings IN and OUT. Separate labels are placed indicating the correct INLET and OUTLET for the Oil Water Separator

13. HP PUMP/MOTOR PLGR VERSATILE 110/220/50/60/1PH - B2151410003 (Standard)

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	15AC062412	MOTOR 2.5 HP 50/60 110/220	1
2	061142157016	BOLT HEX 3/8-16 X 1 SS	4
3	061080056000	WASHER FLAT 3/8" SS	4
4	061142150016	BOLT HEX 5/16-18 X 1 SS	4
5	061060050000	NUT HEX 5/16-18 W/INSERT SS	4
6	061100049000	WASHER FLAT OS 5/16" SS	8
7	12180512CO	HP PUMP-GP 4.2 GPM SS LEFTHAND	1
8	1920016590	STRAIN RELIEF 90, .50 BLK W-NUT	1
9	4928402800	CONDUIT 1/2" (FLEX) BLK	1
10	1317021969	ELB90 -6 FLARE X 3/8 MPT SS	1
11	0112072600	ELB90 1/2 MPT X 3/4 BARB NYLON	1
12	1904040600	STRAIN RELIEF 1/2" BLK LT50P	1

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
B654080002	HP PUMP VALVE REBUILD 2.3-4.2G
B653090001	HP PUMP SEAL KIT REBUILD GEN P
B647800003	PUMP OIL 16 OZ

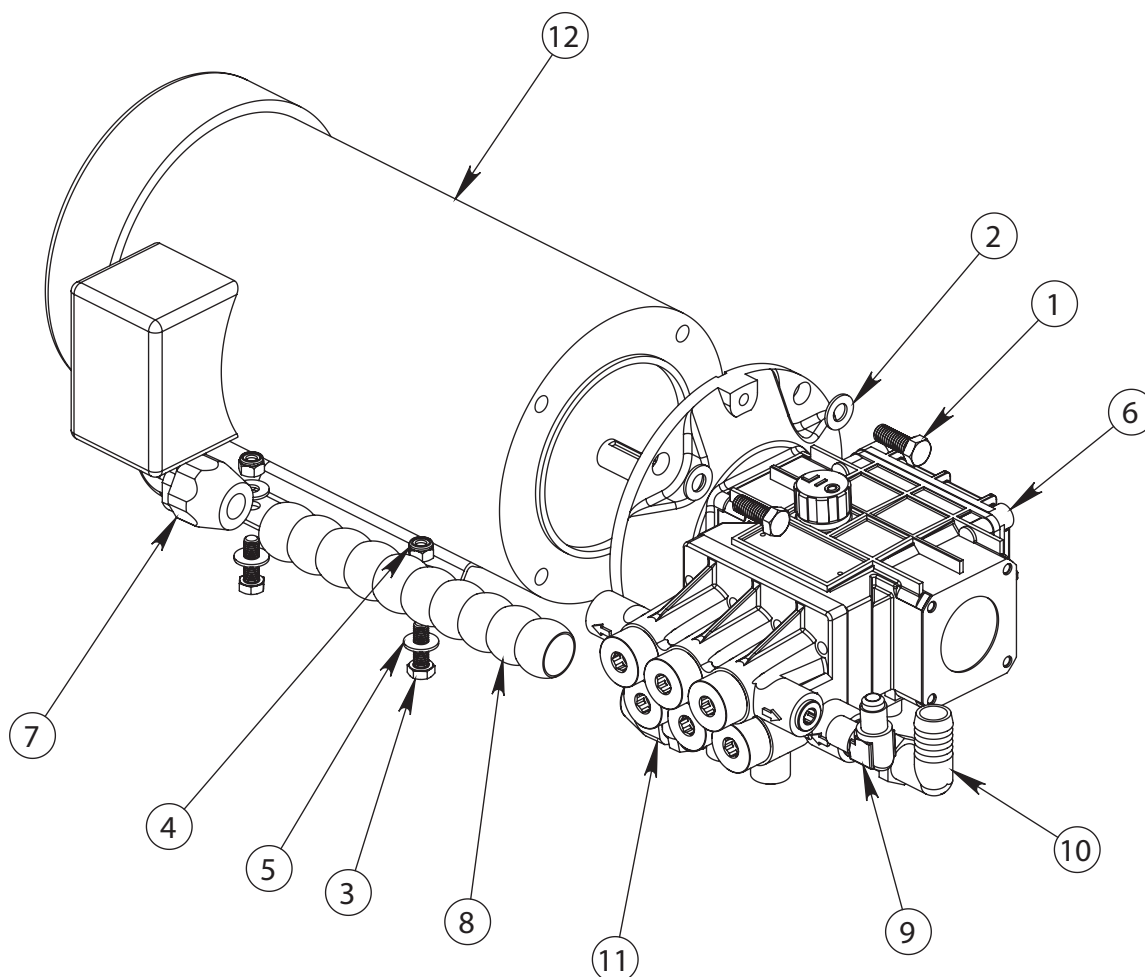


14. HP PUMP/MOTOR PLGR HRO VERSATILE 220/60/3PH - B2151410004 (Standard)

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	061142157016	BOLT HEX 3/8-16 X 1 SS	4
2	061080056000	WASHER FLAT 3/8" SS	4
3	061142150016	BOLT HEX 5/16-18 X 1 SS	4
4	061060050000	NUT HEX 5/16-18 W/INSERT SS	4
5	061100049000	WASHER FLAT OS 5/16" SS	8
6	12180512CO	HP PUMP-GP 4.2 GPM SS LEFTHAND	1
7	1920016590	STRAIN RELIEF 90, .50 BLK W-NUT	1
8	4928402800	CONDUIT 1/2" (FLEX) BLK	1
9	1317021969	ELB90 -6 FLARE X 3/8 MPT SS	1
10	0112072600	ELB90 1/2 MPT X 3/4 BARB NYLON	1
11	1904040600	STRAIN RELIEF 1/2" BLK LT50P	1
12	15AE231012	MOTOR 3 HP 220/60-440/60 3PH	1

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
B654080002	HP PUMP VALVE REBUILD 2.3-4.2G
B653090001	HP PUMP SEAL KIT REBUILD GEN P
B647800003	PUMP OIL 16 OZ

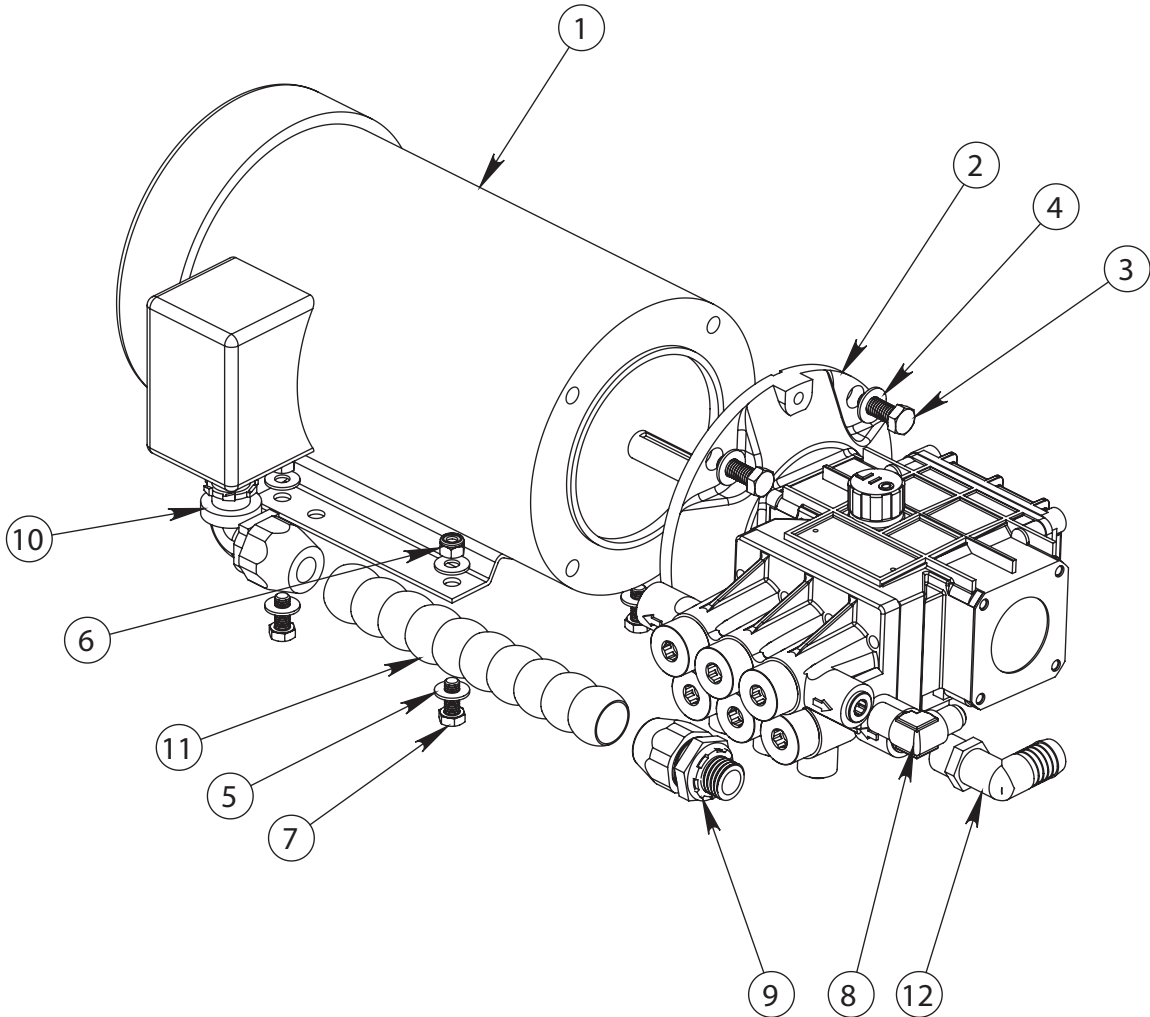


15. HP PUMP/MOTOR PLGR HRO VERSATILE 220/380/50/3 - B2151410005 (Standard)

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	15AF241012	MOTOR 3 HP 220/380 -50/3PH	1
2	12180512CO	HP PUMP-GP 4.2 GPM SS LEFTHAND	1
3	061142157016	HEX BOLT 3/8-16 X 1 SS	4
4	061080056000	WASHER FLAT 3/8" SS	4
5	061100049000	WASHER FLAT OS 5/16" SS	8
6	061060050000	NUT HEX 5/16-18 W/INSERT SS	4
7	061142150012	BOLT HEX 5/16-18 X 3/4 SS	4
8	1317021969	ELB90 -6 FLARE X 3/8 MPT SS	1
9	1904040600	STRAIN RELIEF 1/2" BLK LT50P	1
10	1920016590	STRAIN RELIEF 90, .50 BLK W-NUT	1
11	4928402800	CONDUIT 1/2" (FLEX) BLK	1
12	0112072600	ELB90 1/2 MPT X 3/4 BARB NYLON	1

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
B654080002	HP PUMP VALVE REBUILD 2.3-4.2G
B653090001	HP PUMP SEAL KIT REBUILD GEN P
B647800003	PUMP OIL 16 OZ



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16. HP PUMP ASSY-12180513CO (Standard)

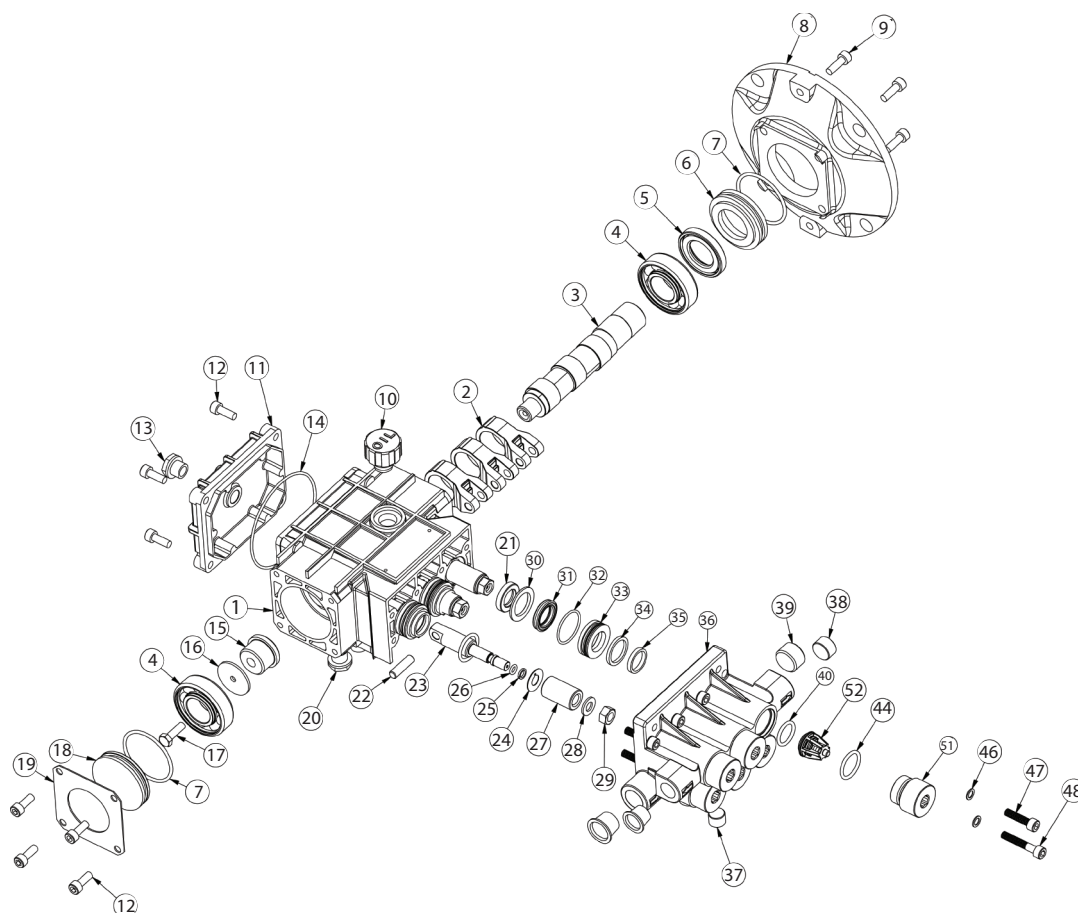
ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1-52	12180511CO	Pump HP 3.0 GPM SS Left (complete high pressure pump)	1
	12180512CO	Pump HP 4.2 GPM SS Left (complete high pressure pump)	
1-29	12180511CO-CCAL	Crank Case Stuffed HP 3.0 GPM SS Left	1
	12180512CO-CCAL	Crank Case Stuffed HP 4.2 GPM SS Left	
30-52	12180511CO-WE	Manifold Stuffed HP 3.0 GPM SS	1
	12180512CO-WE	Manifold Stuffed HP 4.2 GPM SS	
1	12180510CO-01	Crankcase	1
2	12180510CO-02	Connecting Rod	3
3	12180511CO-03	Crankshaft 5/8" Hollow 3.0 GPM	1
	12180512CO-03	Crankshaft 5/8" Hollow 4.2 GPM	
4	12180510CO-04	Bearing	2
5	12180510CO-05	Oil Seal, Crankshaft	1
6	12180510CO-06	Retainer, Oil Seal	1
7	12180510CO-07	O-ring, Oil Seal Retainer/Side Cover	2
8	12180510CO-08	Flange, NEMA 56C Face	1
9	12180510CO-09	Screw SHCS 18mm Long	4
10	12180510CO-10	Oil Cap Vented	1
11	12180510CO-11	Rear Cover	1
12	12180510CO-12	Screw SHCS 16mm Long	8
13	12180510CO-13	Sight Glass	1
14	12180510CO-14	O-ring, Rear Cover	1
15	12180510CO-15	Bushing	1
16	12180510CO-16	Washer	1
17	12180510CO-17	Screw HHCS 20mm long	1
18	12180510CO-18	Side Cover	1
19	12180510CO-19	Side Plate	1
20	12180510CO-20	Oil Drain Plug	1
21	12180510CO-21	Oil Seal Plunger	3
22	12180510CO-22	Wrist Pin	3
23	12180510CO-23	Plunger Rod	3
24	12180510CO-24	Slinger	3
25	12180510CO-25	Anti-Extrusion Ring	3
26	12180510CO-26	O-ring Plunger	3
27	12180510CO-27	Plunger 18mm	3
28	12180510CO-28	Washer, Plunger Rod	3
29	12180510CO-29	Nut, Plunger Rod	3
30	12180510CO-30	Seal Retainer	3
31	12180510CO-31	Low Pressure Seal	3
32	12180510CO-32	O-ring Seal Case	3
33	12180510CO-33	Seal case	3
34	12180510CO-34	Square Ring, High Pressure Seal	3
35	12180510CO-35	Glide Ring, High Pressure Seal	3
36	12180510CO-36	Manifold	1
37	12180510CO-37	1/4 NPT Plug	3
38	12180510CO-38	3/8 NPT Plug	1
39	12180510CO-39	1/2 NPT Plug	1
40	12180510CO-40	O-ring Valve Spacer	6

HP Pump Assy - Cont.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
44	12180510CO-44	O-ring Valve Plug	6
46	12180510CO-46	Washer, Ribbed Lock	8
47	12180510CO-47	Screw SHCSM5 x 25mm Long	4
48	12180510CO-48	Screw SHCSM5 x 35mm Long	4
51	12180513CO-51	Valve Cap	6
52	12180510CO-52	Valve Assembly 2.3 through 4.2 GPM	6
	B647800003	Pump Oil 16oz	

REPAIR KITS:

PART NUMBER	MODEL NUMBER	ITEMS IN KIT	PER KIT
B653090001	SRC HPP Seal Kit	25, 26, 30, 31, 32, 33, 34 & 35	3
B654080002	SRC HPP Valve Kit	40, 44 & 52	6
B652090002	SRC HPP Pump Kit	25, 26, 30, 31, 32, 33, 34, 35, 40, 44 & 52	6

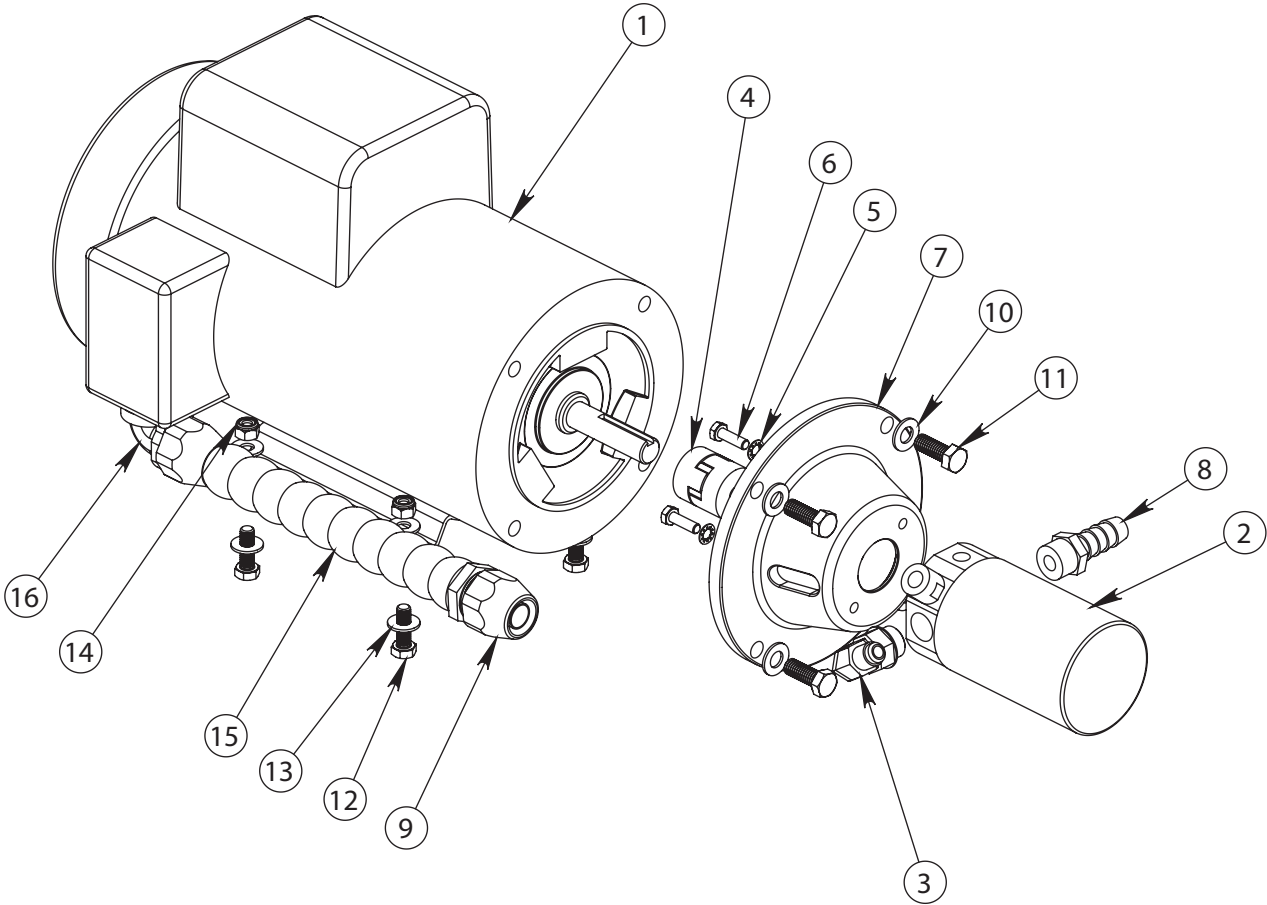


17. HP PUMP / MOTOR ASSY APP 110/220/50/60 1PH - B2151410001 (Optional)

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	15AE261912	MOTOR 3/2.5 HP 115/230 1PH	1
2	12572405DS	HPRA PUMP 4.37 GPM (CP)	1
3	1317021869	ELB90 - 6 FLARE X 3/4 UNF SS	1
4	12207602RW	COUPLER TX1 AQM2	1
5	061120091000	WASHER SPLIT LOCK M6 SS	2
6	061142191174	HEX BOLT M6 X 20MM SS	2
7	1220770101	BELL HOUSING AQ/AW 1PH	1
8	01126526DG	ADAP 1/2 MPT X 3/4 BARB NYLON	1
9	1904040600	STRAIN RELIEF 1/2" BLK LT50P	1
10	061080056000	WASHER FLAT 3/8" SS	4
11	061142157016	BOLT HEX 3/8-16 X 1 SS	4
12	061142150016	BOLT HEX 5/16-18 X 1 SS	4
13	061100049000	WASHER FLAT OS 5/16" SS	8
14	061060050000	NUT HEX 5/16-18 W/INSERT SS	4
15	4928402800	CONDUIT 1/2" (FLEX) BLK	1
16	1920016590	STRAIN RELIEF 90 1/2 BLK W/NUT	1

RECOMMENDED SPARES

PART NUMBER	DESCRIPTION
B653DF0003	SEAL KIT 4.37 V2 >06/08

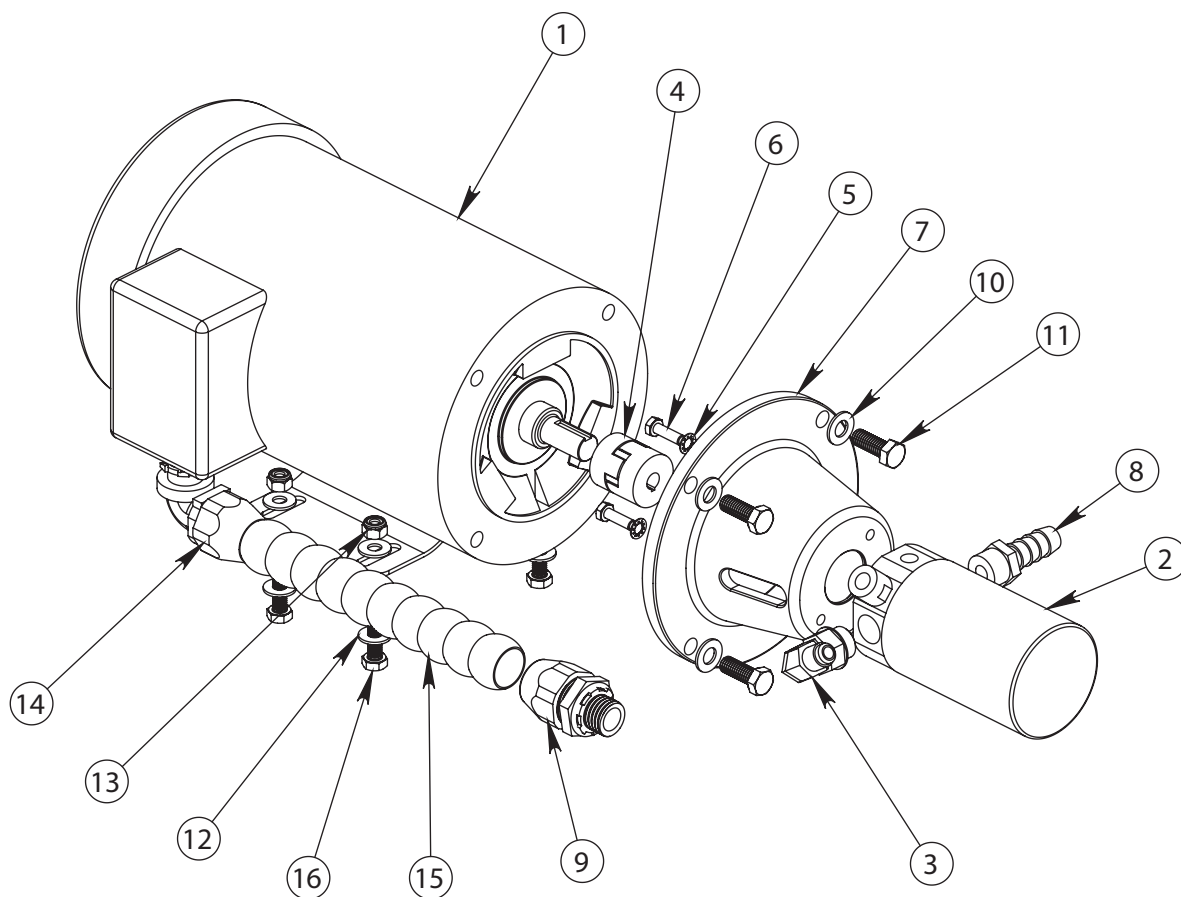


18. HP PUMP / MOTOR ASSY APP 220/380/5/6 3PH - B2151410002 (Optional)

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	15AF271910	MOTOR 3/2.5 HP 3 PH AQM 50/6	1
2	12572405DS	HPRA PUMP 4.37 GPM (CP)	1
3	1317021869	ELB90 - 6 FLARE X 3/4 UNF SS	1
4	12207602RW	COUPLER TX1 AQM2	1
5	061120091000	WASHER SPLIT LOCK M6 SS	2
6	061142191174	HEX BOLT M6 X 20MM SS	2
7	1220770103	BELL HOUSING AQ/AW 3PH	1
8	01126526DG	ADAP 1/2 MPT X 3/4 BARB NYLON	1
9	1904040600	STRAIN RELIEF 1/2" BLK LT50P	1
10	061080056000	WASHER FLAT 3/8" SS	4
11	061142157016	BOLT HEX 3/8-16 X 1 SS	4
12	061100049000	WASHER FLAT OS 5/16" SS	8
13	061060050000	NUT HEX 5/16-18 W/INSERT SS	4
14	1920016590	STRAIN RELIEF 90 1/2 BLK W/NUT	1
15	4928402800	CONDUIT 1/2" (FLEX) BLK	1
16	061142150016	BOLT HEX 5/16-18 X 1 SS	4

RECOMMENDED SPARES

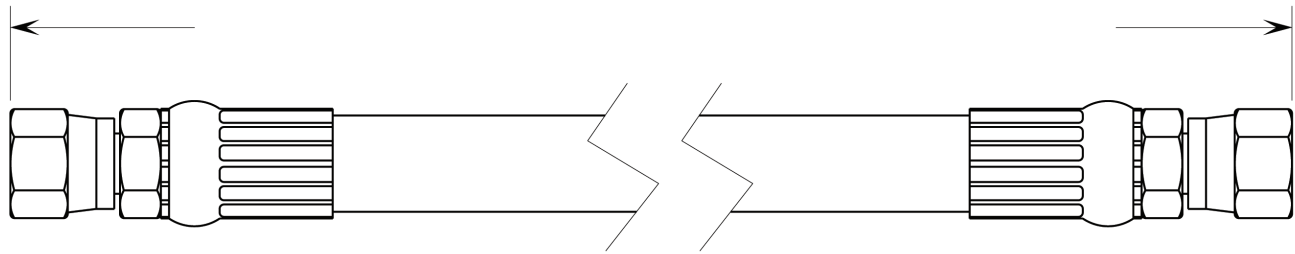
PART NUMBER	DESCRIPTION
B653DF0003	SEAL KIT 4.37 V2 >06/08



19. HP HOSE ASSEMBLY

PART NUMBER	DESCRIPTION	QTY
2432160669	HOSE HP - 6P	1
1317481969	SWIVEL FITTING - 6 SSP	2

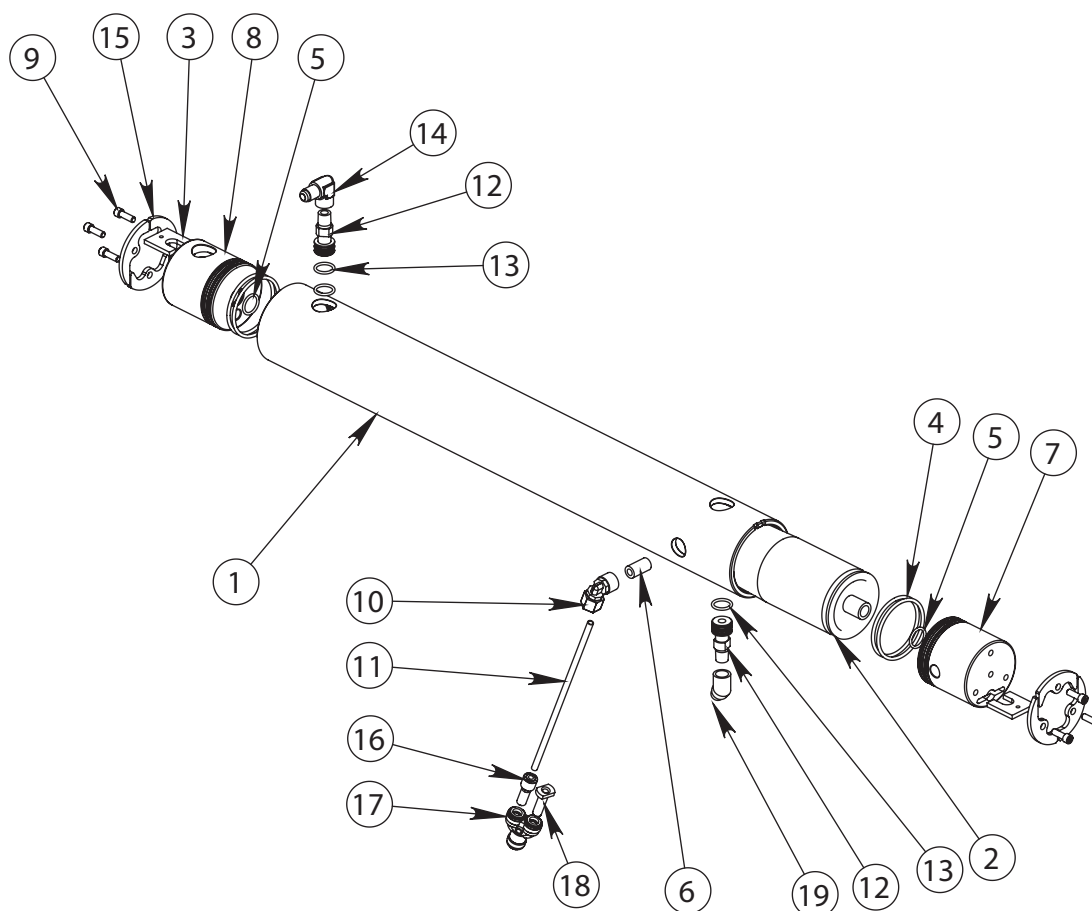
SPECIFY PART NUMBER AND DESCRIPTION OF SPECIFIC HIGH PRESSURE HOSE ASSEMBLY
OR IF A SPECIAL LENGTH IS REQUIRED, SPECIFY MEASURED OVERALL LENGTH: FITTING TO FITTING



OVERALL LENGTH IS + / - 1/4" (6mm)

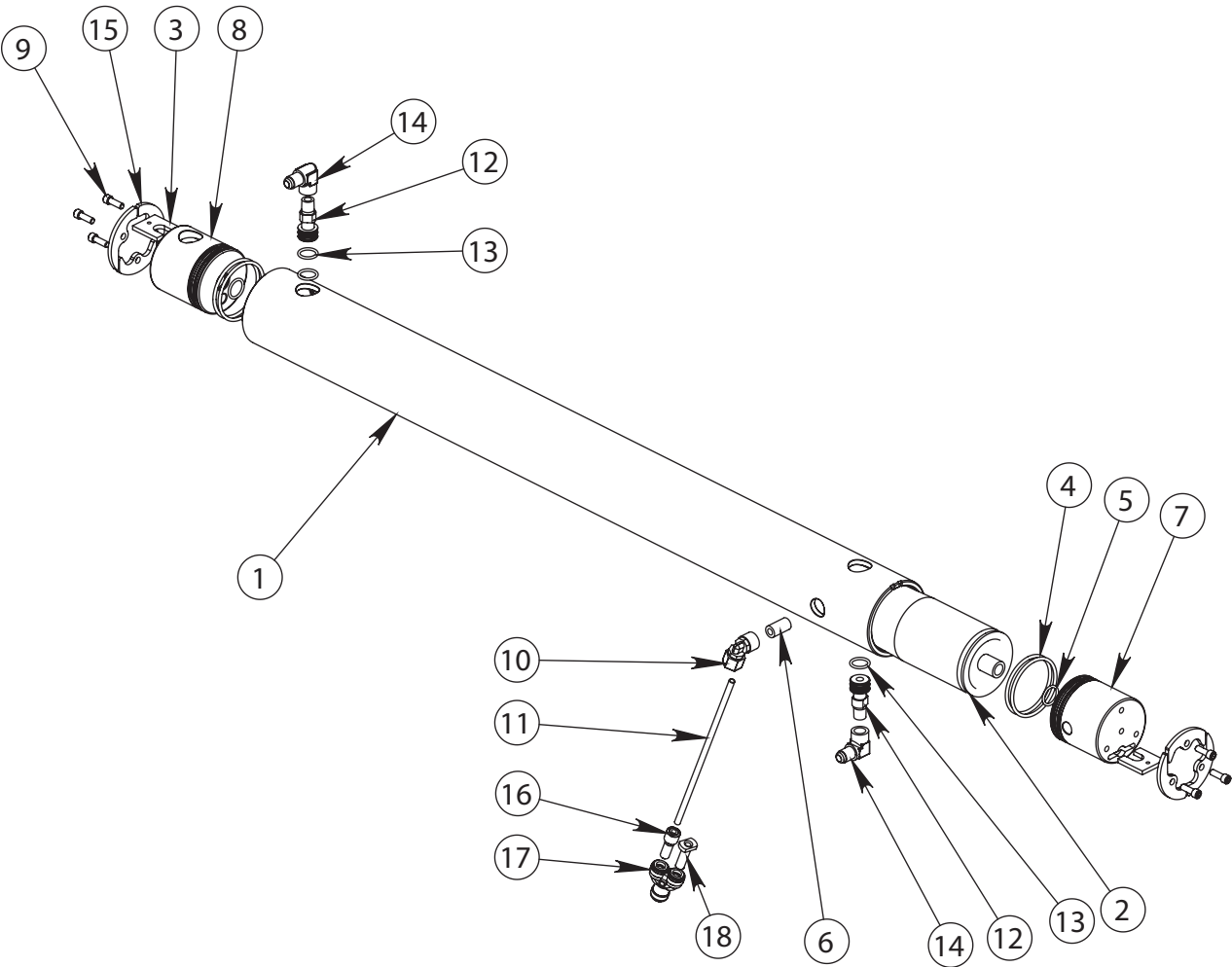
20. MEMBRANE RACK 450-1 STD WITH MEMBRANE - H2221410001

ITEM	PART NUMBER	DESCRIPTION	QTY
1	2408132500	VESSEL HIGH PRESSURE 450 GPD	1
2	2724011233	MEMBRANE 450 GPD W-SEAL	1
3	0520210600	RETAINER PORT MVA AW	2
4	2614014900	O-RING 230 BRINE 3" END PLUG	4
5	2614010100	O-RING 116 PRODUCT	2
6	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC	1
7	2453512400	END PLUG DUAL 3" AW	1
8	2453502401	END PLUG SINGLE 3 AW LONGER	1
9	061162345012	SC SOC CAP 1/4-20 X 3/4 SS	6
10	0204010869	ELB90 1/4 TUBE X 1/4 FNPT PLASTIC	1
11	0312121969	TUBE 1/4 BLACK	1
12	0117410800	NIPPLE HP MVA AW	2
13	2614017900	O-RING 115 INTERCONNECT AW	4
14	1317011769	ELB90 6 FLARE X .25 FPT SS	1
15	20201030000	SEGMENT RING AW (SET)	2
16	0204690100	REDUCER .375 x .25 JQ	1
17	0204741800	UNION TEE 3/8 X 3/8 X 3/8 DIV	1
18	0204990200	PLUG .375 JQ	1
19	1317064800	ELB45 6 FLARE x .25 FNPT SS	1



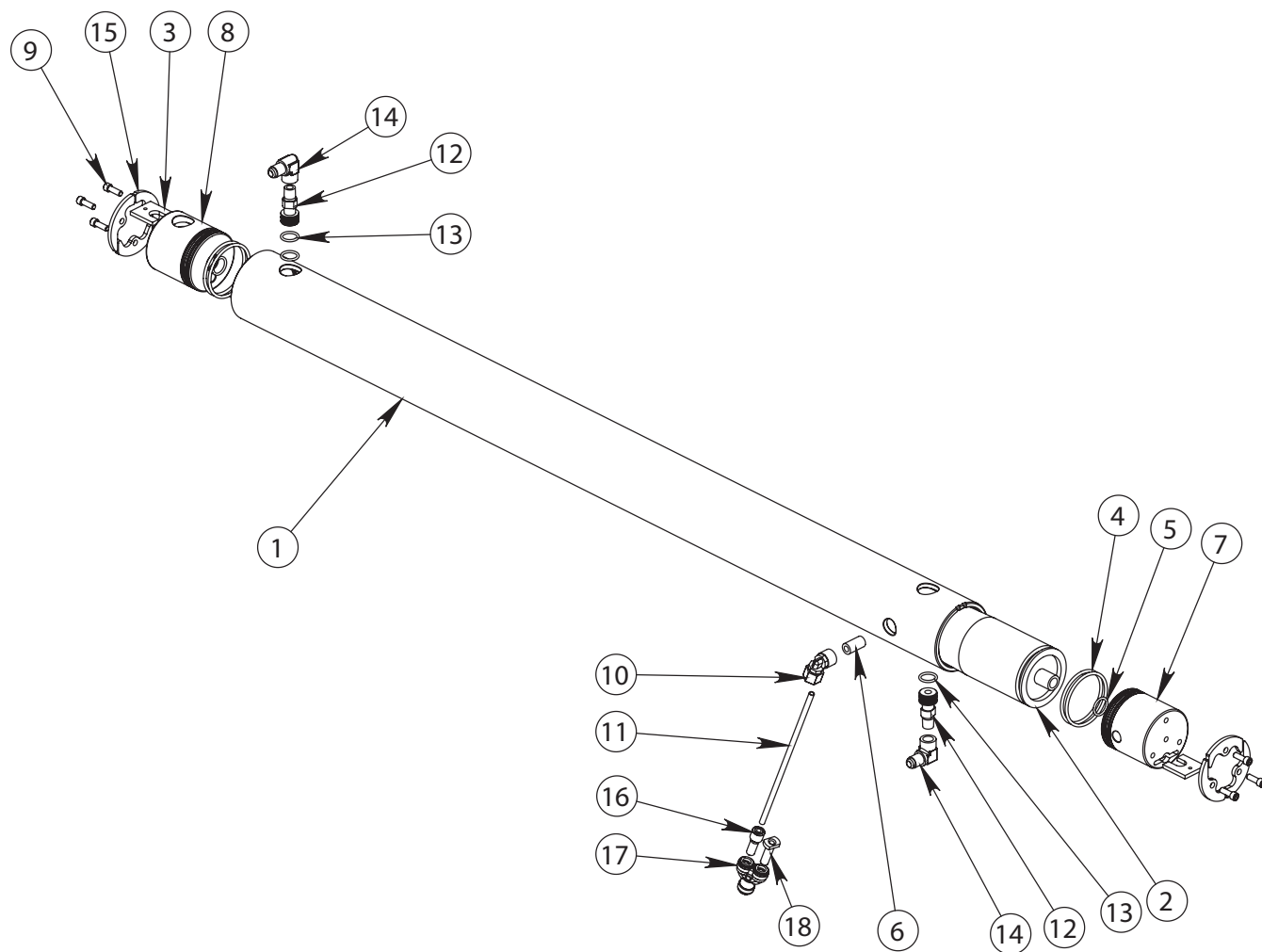
21. MEMBRANE RACK 700-1 STD WITH MEMBRANE - H2221410002

ITEM	PART NUMBER	DESCRIPTION	QTY
1	2408132500-01	VESSEL HIGH PRESSURE 700GPD	1
2	2724011333	MEMBRANE 700GPD W-SEAL	1
3	0520210600	RETAINER PORT MVA AW	2
4	2614014900	O-RING 230 BRINE 3" END PLUG	4
5	2614010100	O-RING 116 PRODUCT	2
6	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC	1
7	2453512400	END PLUG DUAL 3" AW	1
8	2453502401	END PLUG SINGLE 3 AW LONGER	1
9	061162345012	SC SOC CAP 1/4-20 X 3/4 SS	6
10	0204010869	ELB90 1/4 TUBE X 1/4 FNPT PLASTIC	1
11	0312121969	TUBE 1/4 BLACK	1
12	0117410800	NIPPLE HP MVA AW	2
13	2614017900	O-RING 115 INTERCONNECT AW	4
14	1317011769	ELB90 6 FLARE X .25 FPT SS	2
15	20201030000	SEGMENT RING AW (SET)	2
16	0204690100	REDUCER .375 x .25 JQ	1
17	0204741800	UNION TEE 3/8 X 3/8 X 3/8 DIV	1
18	0204990200	PLUG .375 JQ	1



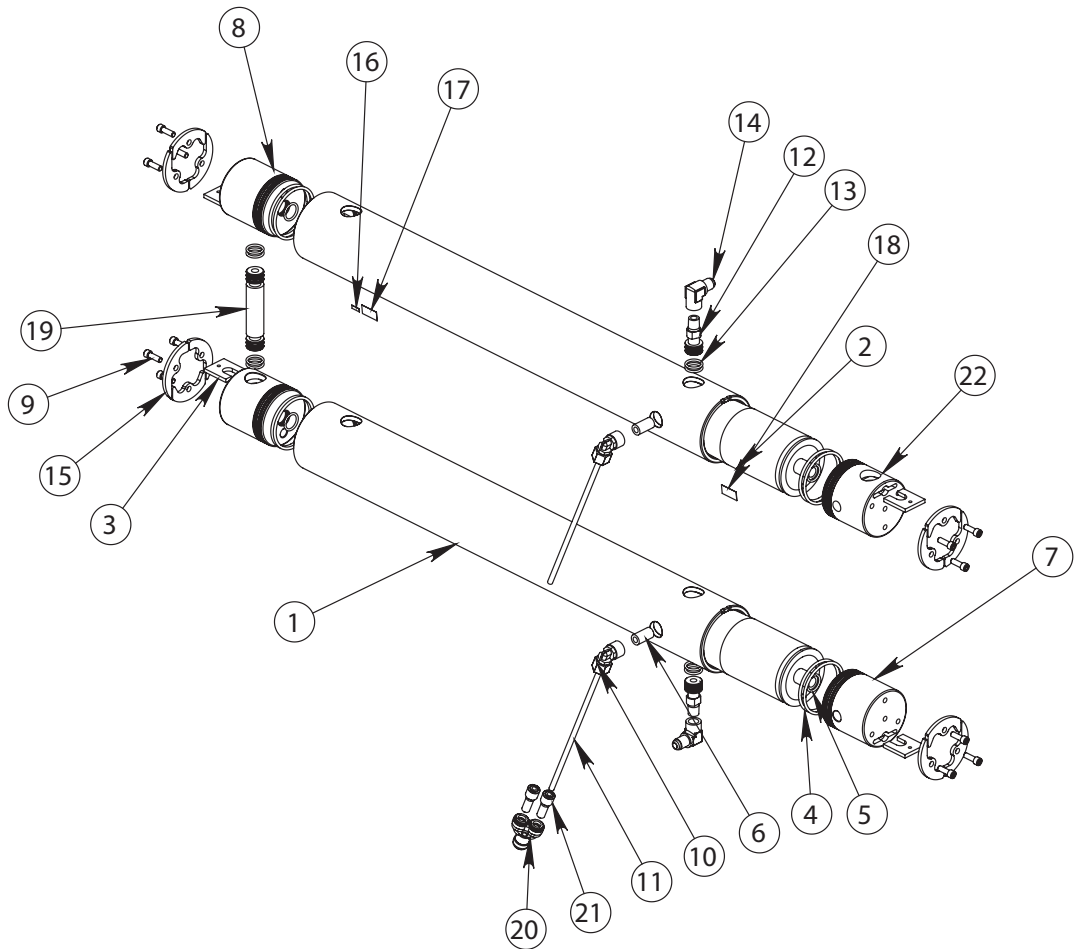
22. MEMBRANE RACK 900-1 STD WITH MEMBRANE - H2221410003

ITEM	PART NUMBER	DESCRIPTION	QTY
1	2408132500-02	VESSEL HIGH PRESSURE 900GPD	1
2	2724011433	MEMBRANE 900GPD W-SEAL	1
3	0520210600	RETAINER PORT MVA AW	2
4	2614014900	O-RING 230 BRINE 3" END PLUG	4
5	2614010100	O-RING 116 PRODUCT	2
6	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC	1
7	2453512400	END PLUG DUAL 3" AW	1
8	2453502401	END PLUG SINGLE 3 AW LONGER	1
9	061162345012	SC SOC CAP 1/4-20 X 3/4 SS	6
10	0204010869	ELB90 1/4 TUBE X 1/4 FNPT PLASTIC	1
11	0312121969	TUBE 1/4 BLACK	1
12	0117410800	NIPPLE HP MVA AW	2
13	2614017900	O-RING 115 INTERCONNECT AW	4
14	1317011769	ELB90 6 FLARE X .25 FPT SS	2
15	20201030000	SEGMENT RING AW (SET)	2
16	0204690100	REDUCER .375 x .25 JQ	1
17	0204741800	UNION TEE 3/8 X 3/8 X 3/8 DIV	1
18	0204990200	PLUG .375 JQ	1



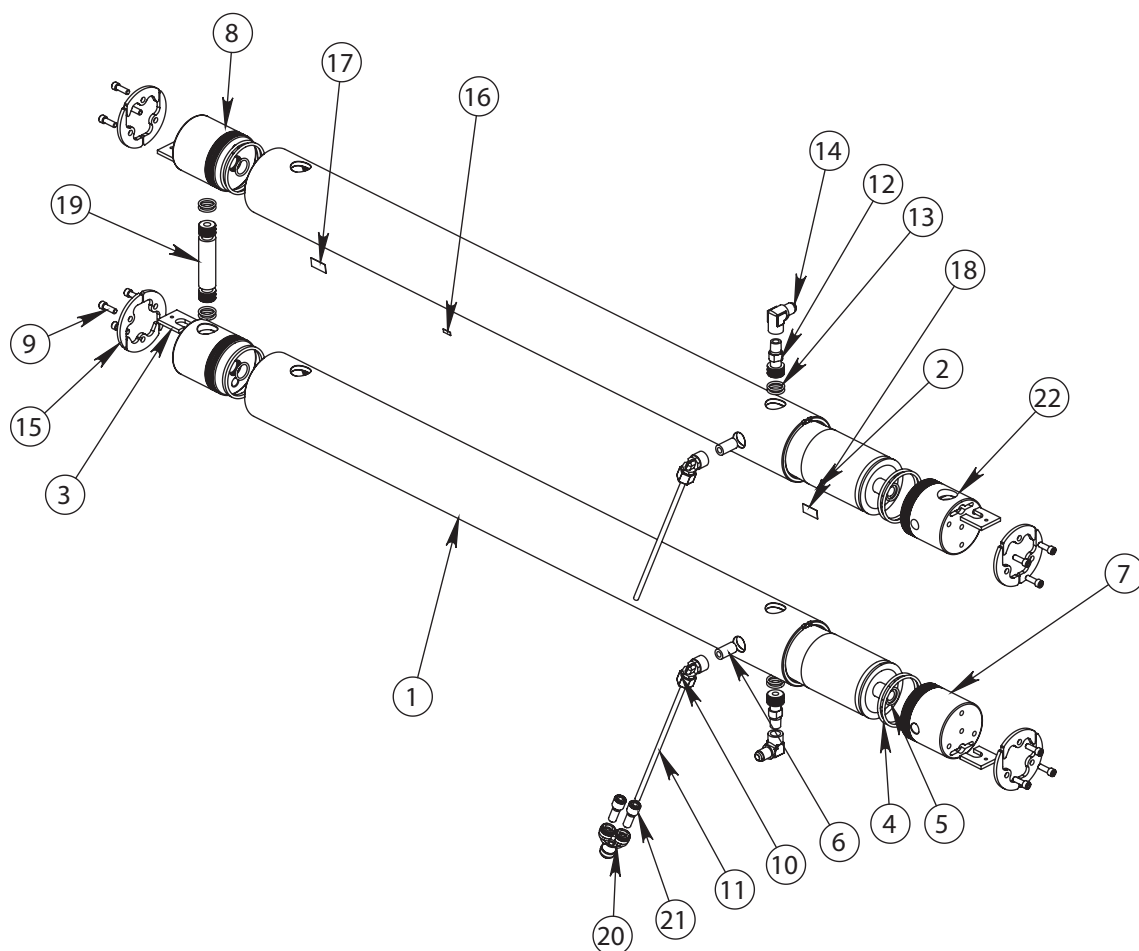
23. MEMBRANE RACK 900-2 STD WITH MEMBRANES - H2221410004

ITEM	PART NUMBER	DESCRIPTION	QTY
1	2408132500	VESSEL HIGH PRESSURE 450GPD	2
2	2724011233	MEMBRANE 450 GPD W-SEAL	2
3	0520210600	RETAINER PORT MVA AW	4
4	2614014900	O-RING 230 BRINE 3" END PLUG	8
5	2614010100	O-RING 116 PRODUCT	4
6	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC	2
7	2453512400	END PLUG DUAL 3" AW	1
8	2453502401	END PLUG SINGLE 3 AW LONGER	2
9	061162345012	SC SOC CAP 1/4-20 X 3/4 SS	12
10	0204010869	ELB90 1/4 TUBE X 1/4 FNPT PLASTIC	2
11	0312121969	TUBE 1/4 BLACK	2
12	0117410800	NIPPLE HP MVA AW	2
13	2614017900	O-RING 115 INTERCONNECT AW	8
14	1317011769	ELB90 6 FLARE X .25 FPT SS	2
15	20201030000	SEGMENT RING AW (SET)	4
16	22200106WE	LABEL MEMBRANE SERIAL NO HRO	2
17	2234011260	LABEL INLET (SRC BLUE)	2
18	2234011360	LABEL OUTLET (SRC BLUE)	2
19	2417430800	INTERCONNECT MVA SS AW	1
20	0204741800	UNION TEE 3/8 X 3/8 X 3/8 DIV	1
21	0204690100	REDUCER .375 x .25 JQ	2
22	H36160522400	END PLUG 3" DUAL, HORIZON SEA	1



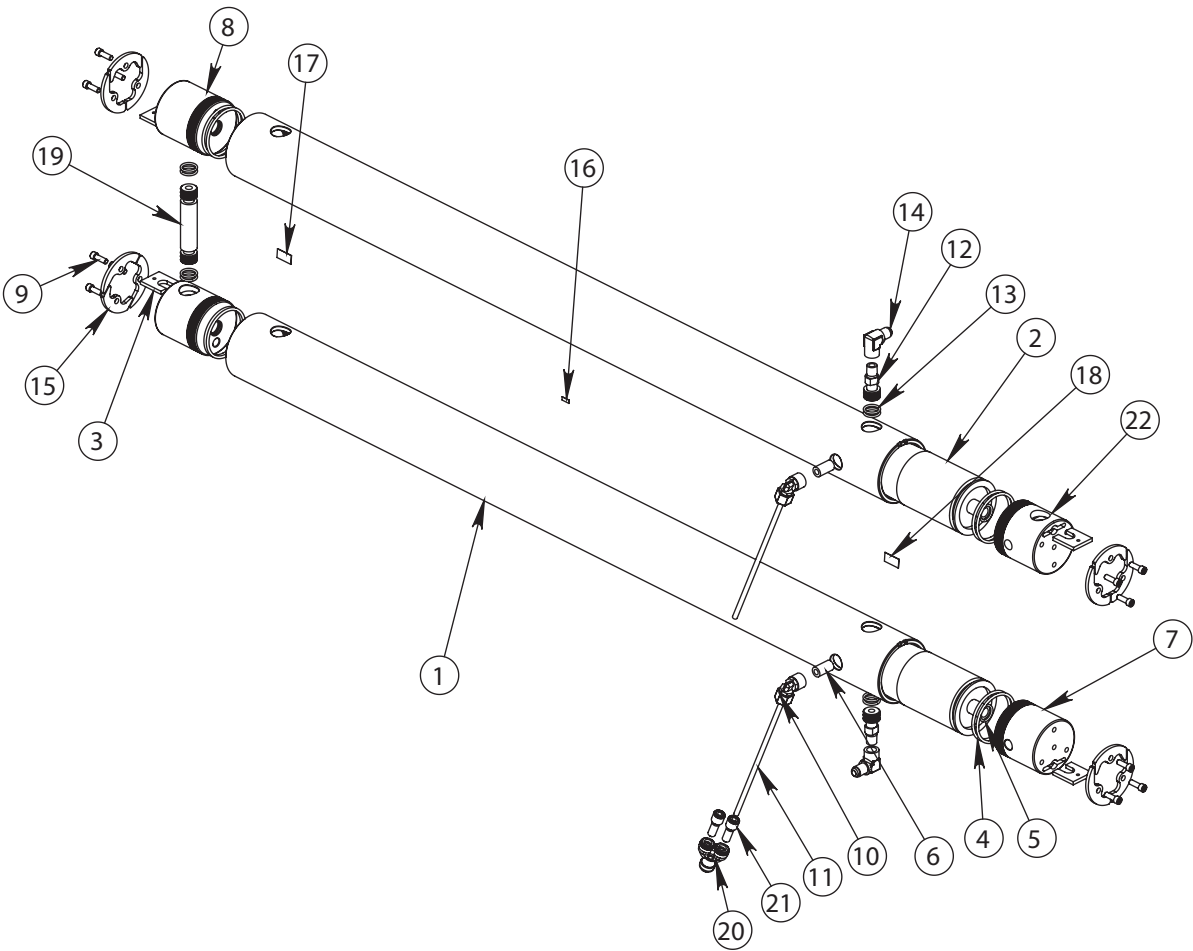
24. MEMBRANE RACK 1400-2 STD WITH MEMBRANES - H2221410005

ITEM	PART NUMBER	DESCRIPTION	QTY
1	2408132500-01	VESSEL HIGH PRESSURE 700GPD	2
2	2724011333	MEMBRANE 700GPD W-SEAL	2
3	0520210600	RETAINER PORT MVA AW	4
4	2614014900	O-RING 230 BRINE 3" END PLUG	8
5	2614010100	O-RING 116 PRODUCT	4
6	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC	2
7	2453512400	END PLUG DUAL 3" AW	1
8	2453502401	END PLUG SINGLE 3 AW LONGER	2
9	061162345012	SC SOC CAP 1/4-20 X 3/4 SS	12
10	0204010869	ELB90 1/4 TUBE X 1/4 FNPT PLASTIC	2
11	0312121969	TUBE 1/4 BLACK	2
12	0117410800	NIPPLE HP MVA AW	2
13	2614017900	O-RING 115 INTERCONNECT AW	8
14	1317011769	ELB90 6 FLARE X .25 FPT SS	2
15	20201030000	SEGMENT RING AW (SET)	4
16	22200106WE	LABEL MEMBRANE SERIAL NO HRO	2
17	2234011260	LABEL INLET (SRC BLUE)	2
18	2234011360	LABEL OUTLET (SRC BLUE)	2
19	2417430800	INTERCONNECT MVA SS AW	1
20	0204741800	UNION TEE 3/8 X 3/8 X 3/8 DIV	1
21	0204690100	REDUCER .375 x .25 JQ	2
22	H36160522400	END PLUG 3" DUAL, HORIZON SEA	1



25. MEMBRANE RACK 1800-2 STD WITH MEMBRANES - H2221410006

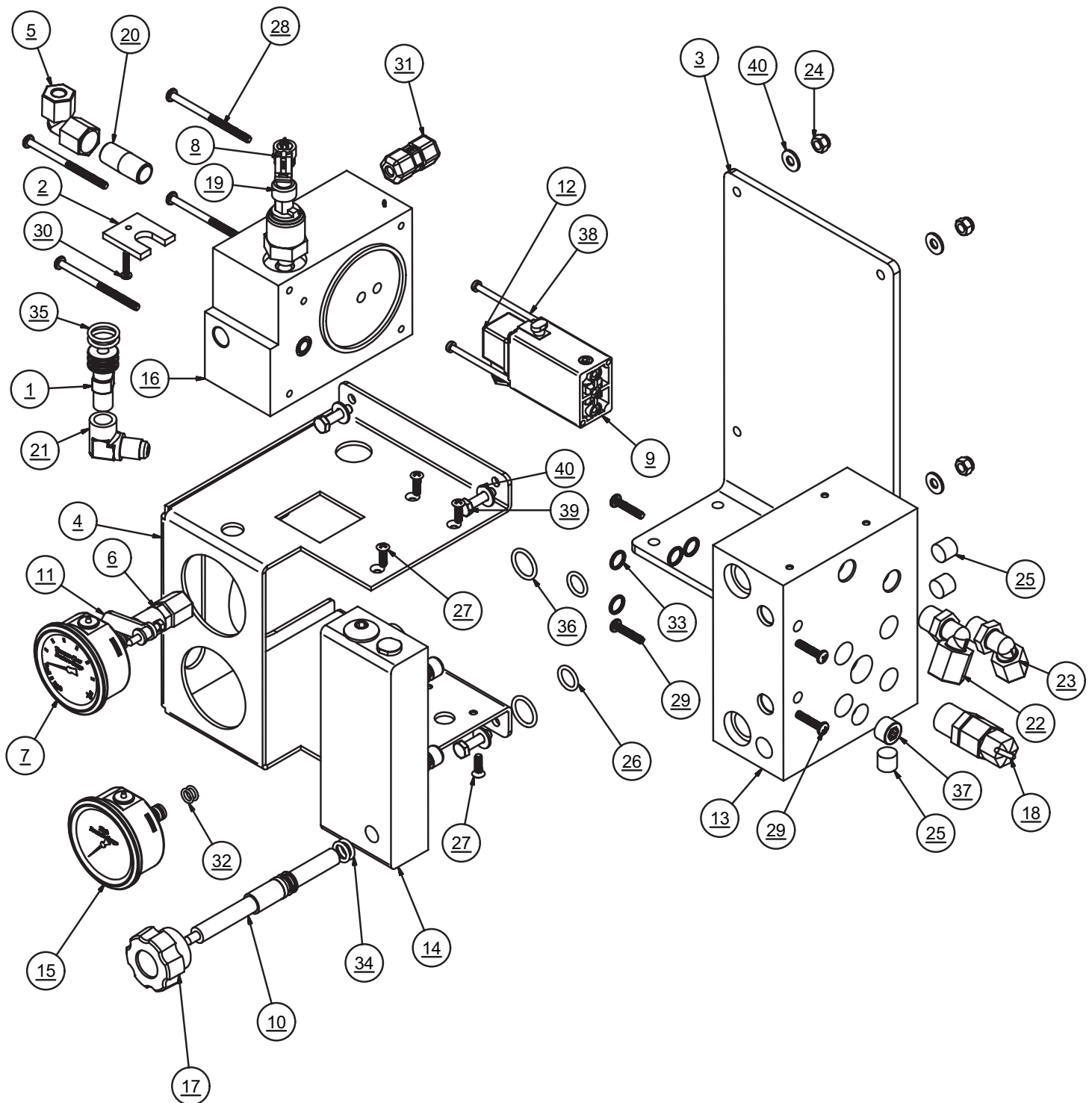
ITEM	PART NUMBER	DESCRIPTION	QTY
1	2408132500-02	VESSEL HIGH PRESSURE 900GPD	2
2	2724011433	MEMBRANE 900 GPD AW W/SEAL	2
3	0520210600	RETAINER PORT MVA AW	4
4	2614014900	O-RING 230 BRINE 3" END PLUG	8
5	2614010100	O-RING 116 PRODUCT	4
6	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC	2
7	2453512400	END PLUG DUAL 3" AW	1
8	2453502401	END PLUG SINGLE 3 AW LONGER	2
9	061162345012	SC SOC CAP 1/4-20 X 3/4 SS	12
10	0204010869	ELB90 1/4 TUBE X 1/4 FNPT PLASTIC	2
11	0312121969	TUBE 1/4 BLACK	2
12	0117410800	NIPPLE HP MVA AW	2
13	2614017900	O-RING 115 INTERCONNECT AW	8
14	1317011769	ELB90 6 FLARE X .25 FPT SS	2
15	20201030000	SEGMENT RING AW (SET)	4
16	22200106WE	LABEL MEMBRANE SERIAL NO HRO	2
17	2234011260	LABEL INLET (SRC BLUE)	2
18	2234011360	LABEL OUTLET (SRC BLUE)	2
19	2417430800	INTERCONNECT MVA SS AW	1
20	0204741800	UNION TEE 3/8 X 3/8 X 3/8 DIV	1
21	0204690100	REDUCER .375 x .25 JQ	2
22	H36160522400	END PLUG 3" DUAL, HORIZON SEA	1



26. CONTROL MANIFOLD ASSEMBLY HRO,W-TRANSDUCER - EXPLODED H22502210004

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0117410800	FHP NIPPLE 0.25 MPT	1
2	0520210600	RETAINER PORT MVA	1
3	H31740042110	BRACKET CONNECTION MANIFOLD RM	1
4	H31740082108	GAUGE & SWITCH COVER HRO	1
5	0204011869	ELBOW,PP,3/8 ODx3/8 FT	1
6	0204120869	FITTING, PP, 1/2"OD X 1/2FT	1
7	10181522CC	GAUGE -30-0-70 CBM.NPT	1
8	2317100200-1	TRANSDUCER CLIP	1
9	1401096100	VALVE SOLENOID 12VDC	1
10	H317481121005	BACKPRESSURE REGULATOR SHAFT HORIZON SEAFARI	1
11	05180851CC	BRACKET,GAUGE,CBM,SS	1
12	3131680100	CONNECTOR,PLUG,SWITCH,4 DIN	1
13	H33260210100	CONTROL MANIFOLD HORIZON SEAFARI	1
14	H2510210001	FLOW METER.5-5GPM & 7-70GPH	1
15	10181421CC	GAUGE 0-1400 CBM.O-RING SEAL	1
16	H33260210202	GAUGE BLOCK,HP,TRANS,RM	1
17	H32458020158	KNOB BP REGULATOR	1
18	B511080003	SALINITY PROBE ASSY	1
19	2317100300	TRANSDUCER 0-2000 PSI .437 SAE	1
20	0101371815	NIP 3-8NPTx1-1_2L PVC80	1
21	1317011769	ELB90 6 FLARE X .25 FPT SS	1
22	0204022469	ELBOW,PP,1/2 ODx3/8 MT	1
23	0204021869	ELBOW,SS,3/8 ODx3/8 MT	1
24	061060045000	NUT HEX .25-20 W-INSERT SS	4
25	0117340800	PLUG SOC ,0.25 MT SS	3
26	2614014600	O-RING 113 PLUG PRODUCT AW-FM	2
27	061161130010	SC PHIL OVAL #10-24x5-8L SS	6
28	061160630048	SC PHIL PAN # 10-24 X 3.00 SS	4
29	061160630016	SC PHIL PAN #10-24x1 L SS	4
30	061170618109	SC PHIL PAN A #6 X .75 SS	1
31	0204210869	UNION CONN .25 TU X .25 TU	1
32	2614015800	O-RING 011 GAUGE-PRES SWITCH	2
33	2614014653	O-RING 013 CAP 5-75	4
34	2614017100	O-RING 111 SALINITY PRB-BPR CS	2
35	2614017900	O-RING 115 INTERCONNECT AW	2
36	2614010100	O-RING 116 PRODUCT AS-AW	2
37	0117341869	PLUG .375 MNPT SS	1
38	061160526048	SC 8-32 x 3.00 SS	2
39	061142145016	SCREW,HEX HEAD,.25-20x1",SS	4
40	061080043000	WASHER,FLAT,1/4",SS	8

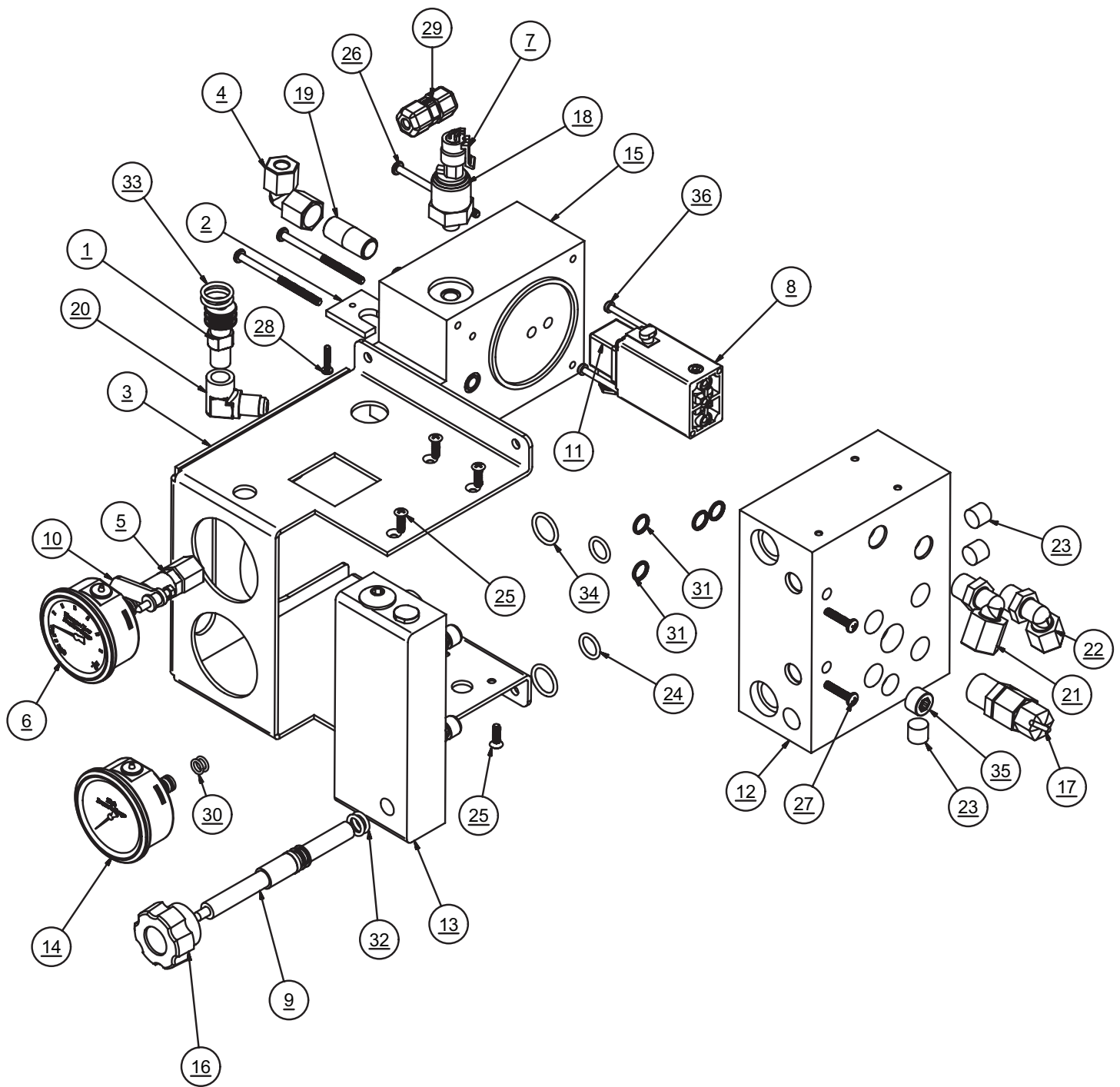
Refer to illustration on next page



CONTROL MANIFOLD ASSEMBLY HRO,W-TRANSDUCER- EXPLODED H22502210005

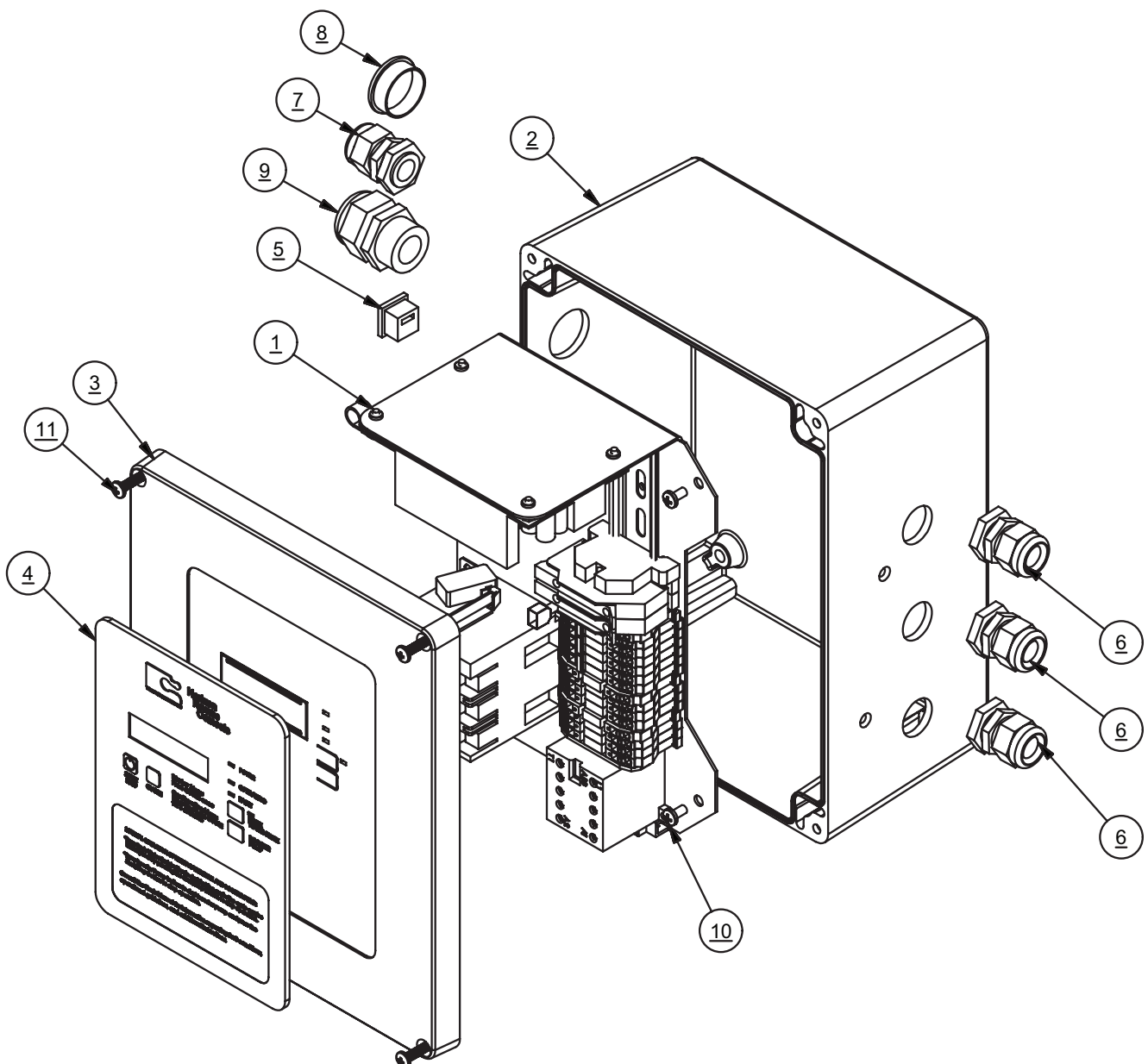
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0117410800	HP NIPPLE 0.25 MPT	1
2	0520210600	RETAINER PORT MVA	1
3	H31740082108	GAUGE & SWITCH COVER HRO	1
4	0204011869	ELBOW,PP,3/8 ODx3/8 FT	1
5	0204120869	FITTING, PP, 1/2"OD X 1/2FT	1
6	10181522CC	GAUGE -30-0-70 CBM.NPT	1
7	2317100200-1	TRANSDUCER CLIP	1
8	1401096100	VALVE SOLENOID 12VDC	1
9	H317481121005	BACKPRESSURE REGULATOR SHAFT HORIZON SEAFARI	1
10	05180851CC	BRACKET,GAUGE,CBM,SS	1
11	3131680100	CONNECTOR,PLUG,SWITCH,4 DIN	1
12	H33260210100	CONTROL MANIFOLD HORIZON SEAFARI	1
13	H2510210001	FLOW METER.5-5GPM & 7-70GPH	1
14	10181421CC	GAUGE 0-1400 CBM.O-RING SEAL	1
15	H33260210202	GAUGE BLOCK,HP,TRANS,RM	1
16	H32458020158	KNOB BP REGULATOR	1
17	B511080003	SALINITY PROBE ASSY	1
18	2317100300	TRANSDUCER 0-2000 PSI .437 SAE	1
19	0101371815	NIP 3-8NPTx1-1_2L PVC80	1
20	1317011769	ELB90 6 FLARE X .25 FPT SS	1
21	0204022469	ELBOW,PP,1/2 ODx3/8 MT	1
22	0204021869	ELBOW,SS,3/8 ODx3/8 MT	1
23	0117340800	PLUG SOC ,0.25 MT SS	3
24	2614014600	O-RING 113 PLUG PRODUCT AW-FM	2
25	061161130010	SC PHIL OVAL #10-24x5-8L SS	6
26	061160630048	SC PHIL PAN # 10-24 X 3.00 SS	4
27	061160630016	SC PHIL PAN #10-24x1 L SS	2
28	061170618109	SC PHIL PAN A #6 X .75 SS	1
29	0204210869	UNION CONN .25 TU X .25 TU	1
30	2614015800	O-RING 011 GAUGE-PRES SWITCH	2
31	2614014653	O-RING 013 CAP 5-75	4
32	2614017100	O-RING 111 SALINITY PRB-BPR CS	2
33	2614017900	O-RING 115 INTERCONNECT AW	2
34	2614010100	O-RING 116 PRODUCT AS-AW	2
35	0117341869	PLUG .375 MNPT SS	1
36	061160526048	SC 8-32 x 3.00 SS	2

Refer to illustration on next page



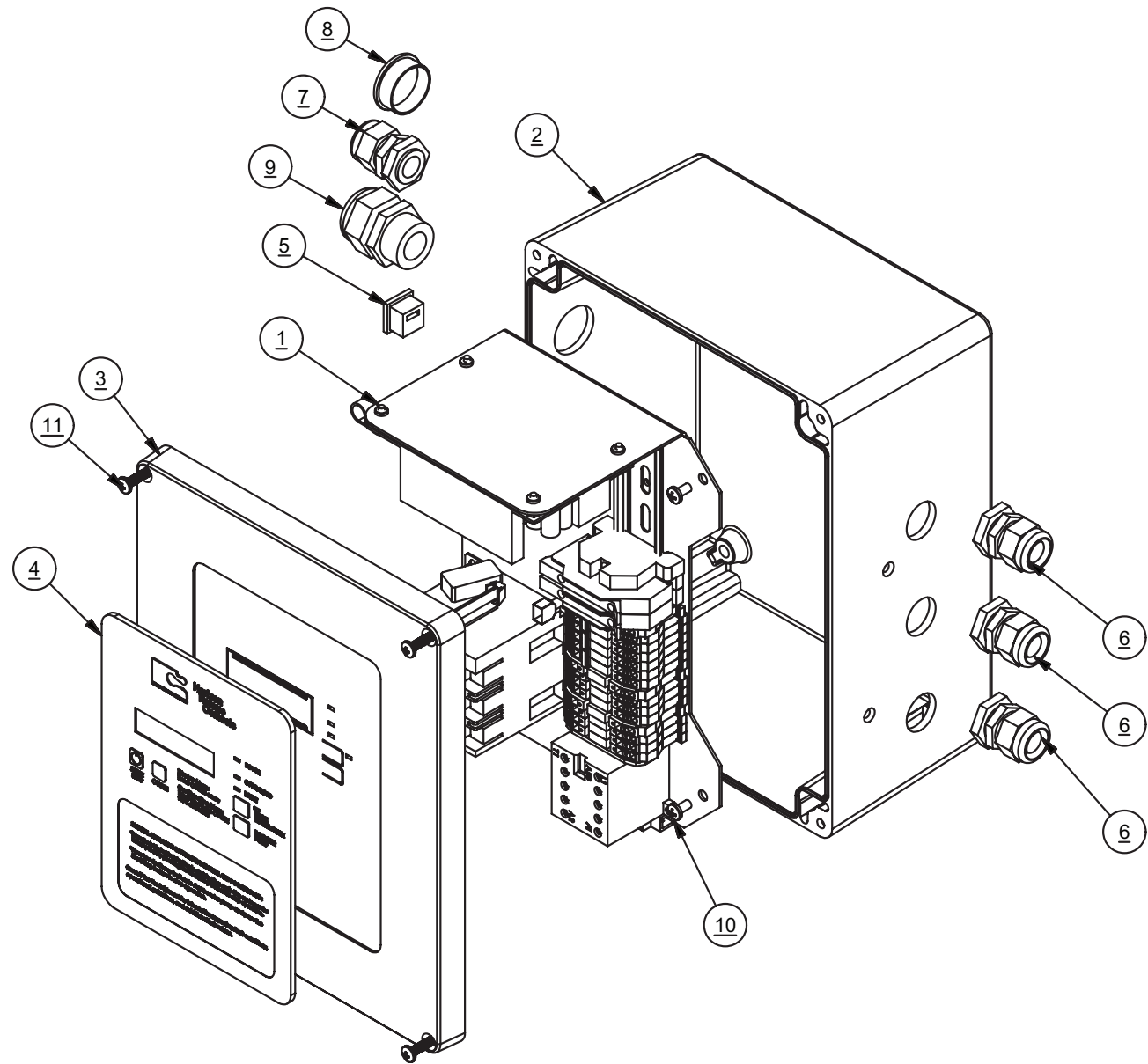
29. MAIN,ENCLOSURE, HORIZON SEAFARI, 1 PHASE - EXPLODED H2600210003

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	H619110003	CHASSIS CONTROLLER SEAFARI VERS, 1 PHASE	1
2	31312282CH	ENCLOSURE CONNECTION, HORIZON SEAFARI, REAR	1
3	31809001RS	LID,CONTROLLER,LCD,9.27 IN X 11.27 IN	1
4	3131561602	OVERLAY, TOUCH PAD (HRO)	1
5	1904019243	STRAIN RELIEF 1834	1
6	1904011800	STRAIN RELIEF 3 HOLE X 6MM	3
7	1904010043	STRAIN RELIEF 3217 .50 IN GREY	1
8	H31031100777	PLUG WHITE DOME 2723	1
9	1904010243	STRAIN RELIEF 3222 .75 BLK	1
10	061160631005	SC PHIL PAN #10-32 X .31 SS	4
11	061160630016	SC PHIL PAN #10-24x1 L SS	4



30. MAIN,ENCLOSURE, HORIZON SEAFARI, 3 PHASE - EXPLODED H2600210004

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	H619110004	CHASSIS CONTROLLER SEAFARI VERS, 3 PHASE	1
2	31312282CH	ENCLOSURE CONNECTION, HORIZON SEAFARI, REAR	1
3	31809001RS	LID,CONTROLLER,LCD,9.27 IN X 11.27 IN	1
4	3131561602	OVERLAY, TOUCH PAD (HRO)	1
5	1904019243	STRAIN RELIEF 1834	1
6	1904011800	STRAIN RELIEF 3 HOLE X 6MM	3
7	1904010043	STRAIN RELIEF 3217 .50 IN GREY	1
8	H31031100777	PLUG WHITE DOME 2723	1
9	1904010243	STRAIN RELIEF 3222 .75 BLK	1
10	061160631005	SC PHIL PAN #10-32 X .31 SS	4
11	061160630016	SC PHIL PAN #10-24x1 L SS	4



**PREFILTRATION CARTRIDGE FILTER ELEMENT WARNING:**

Do not use third party Prefiltration Elements (Plankton Filter Elements, Prefilter Elements, Commercial Prefilter Elements, or Oil/Water Separator Elements). Use only HRO Systems supplied Prefiltration Elements. Third party prefiltration elements on the market do not properly fit into the HRO Systems Filter Housings, the seams fall apart, and they will allow by-pass resulting in EXTENSIVE AND EXPENSIVE DAMAGE TO THE HIGH PRESSURE PUMP AS WELL AS PREMATURE FOULING OF THE R.O. MEMBRANE ELEMENT.

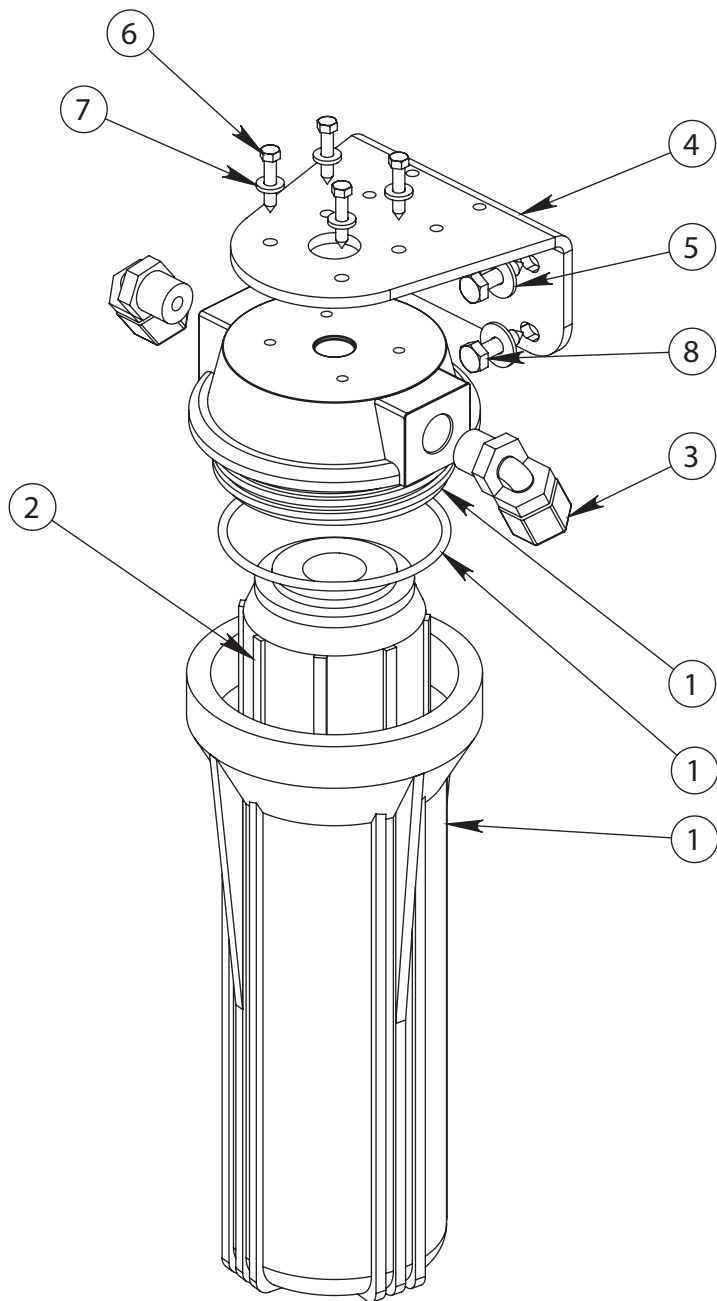
Damage caused to the HRO Systems High Pressure Pump, R.O. Membrane Element, or any other component from the use of third party, non HRO Systems supplied, filter elements is the responsibility and liability of the operator and is not covered by the HRO Systems Warranty.

**FILTER ELEMENT CAUTION:**

Do not use "string wound" or "fiber" type prefilter elements. These type of elements are designed for the Photographic Film Developing industry. When used in sea water they will plug up rapidly in 1/10th or less the time causing frequent shut down of the system and very frequent changing resulting in very high cost of maintenance.

32. PH NEUTRALIZER ASSY -10" H593001001A

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0713020573	FILTER HOUSING/LID 3/8 X 10	1
2	08251950AS	ELEMENT PH 9 3/4"	1
3	0204021869	ELB90 3/8 TUBE X 3/8 MPT PLASTIC	2
4	20200402102	BRACKET SINGLE FILTER	1
5	061100043000	WASHER FLAT OS 1/4"SS	4
6	061170628016	SC PHIL PAN "A" 10 X 1 SS	4
7	065080028000	WASHER FLAT #10 NYLON	4
8	061172143016	SC HEX "A" 1/4 X 1 SS	4



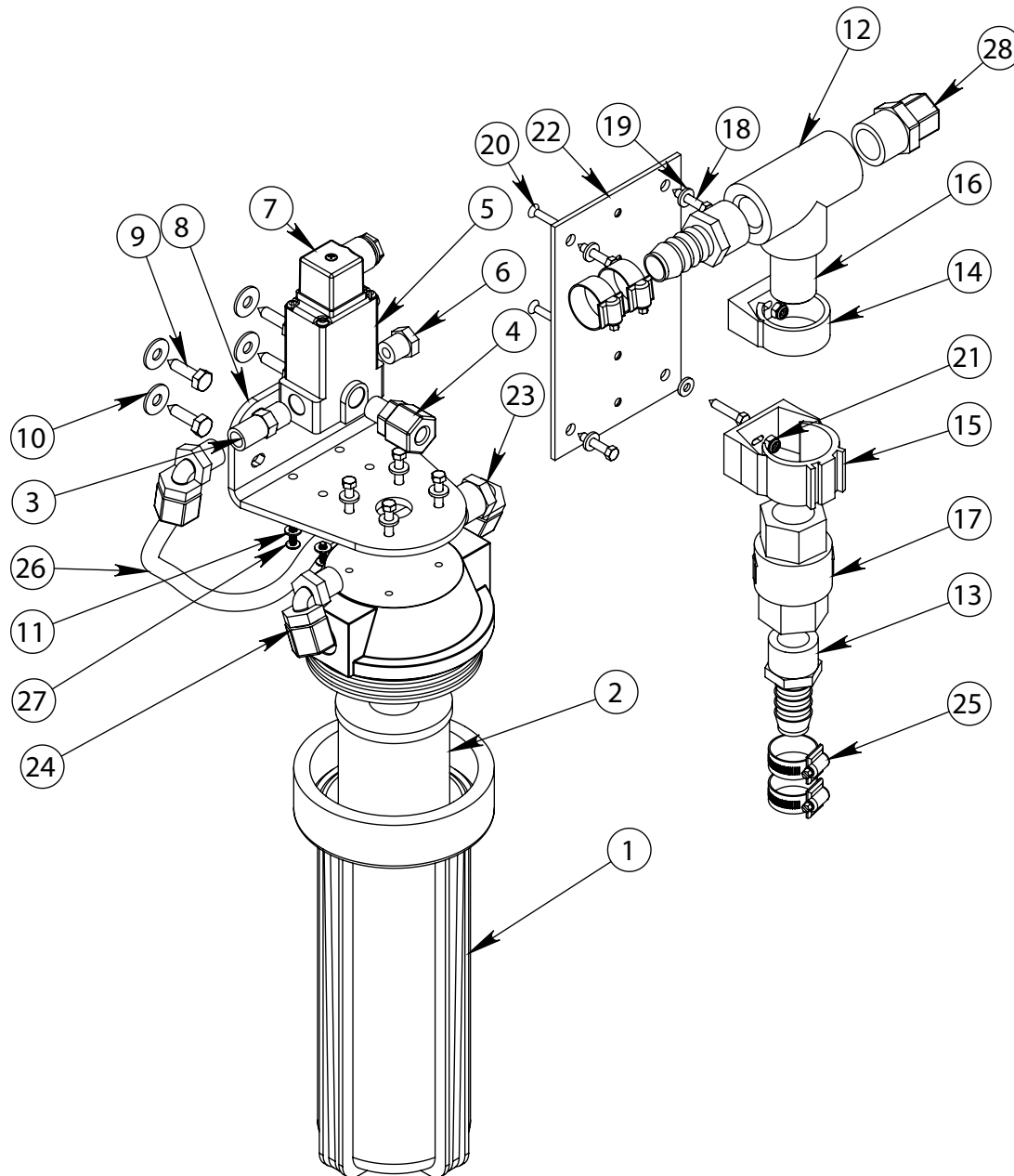
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33. FRESH WATER FLUSH (.50 INCH) B598000008

ITEM	PART NUMBER	DESCRIPTION	U/M	QTY
1	0713020873	FILTER HOUSING 1/2" X 10	EACH	1
2	0803004773	CHARCOAL FILTER 10 IN	EACH	1
3	14172105AT	VALVE CHECK .25 MNPT SS	EACH	1
4	0204091769	CONN 3/8 TUBE X 1/4 MPT PLASTIC	EACH	1
5	1401095998	VALVE SOLENOID 12VDC AED/CSFE	EACH	1
6	0101340883	PLUG 1/4 MPT PVC	EACH	1
7	3131680298	PLUG CONNECTOR DIN 3-PIN	EACH	1
8	20200402102	SINGLE FILTER BRACKET	EACH	1
9	061172143016	SC HEX "A" 1/4 X 1.0 SS	EACH	4
10	061100043000	WASHER FLAT OS 1/4"SS	EACH	4
11	065080023000	WASHER FLAT #8 NYLON	EACH	4
12	0101423783	TEE .75 FNPT x .75 FNPT x .75 FNPT PVC	EACH	1
13	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC	EACH	2
14	0501164200	PIPE SUPPORT 1 1/8" #36	EACH	1
15	0501164500	PIPE SUPPORT 1 1/4"	EACH	1
16	01013737CL	NIPPLE .75 NPT X CLOSE PVC	EACH	1
17	14012118AR	VALVE CHECK .75 FNPT WITH VITO	EACH	1
18	061170628016	SC PHIL PAN "A" 10 X 1 SS	EACH	8
19	065080028000	WASHER FLAT #10 NYLON	EACH	8
20	061161626012	SC PHIL FLAT 8-32 X 3/4 SS	EACH	2
21	061060026000	NUT HEX 8-32 W/INSERT SS	EACH	2
22	2020040002	BRACKET CHECK VALVE FWF	EACH	1
23	0204021969	ELB90 3/8 TUBE X 1/2 MPT PLAST	EACH	1
24	0204011769	ELB90 .375 TUBE x .25 FNPT PLASTIC	EACH	2
25	05181432AA	HOSE CLAMP 1/2" SS	EACH	4
26	0312123569	TUBE .375 BLACK	FEET	15
27	061170623008	SC PHIL PAN "B" #8 X 1/2" SS	EACH	4
28	0204092069	CONN 3/8 TUBE X 3/4 MPT PLASTIC	EACH	1

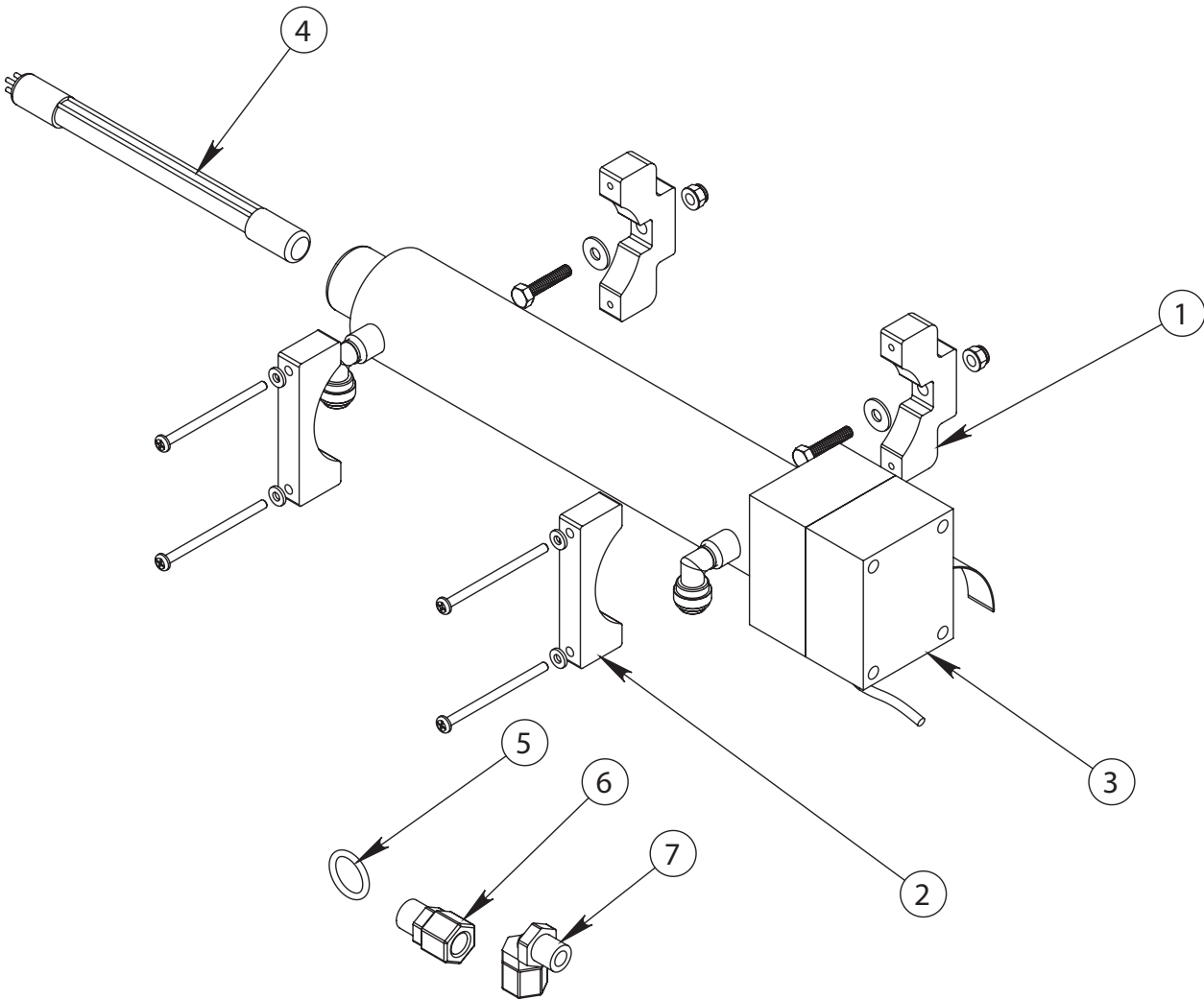
Refer to illustration on page 10-47

FRESH WATER FLUSH (.50 INCH) B598000008 - Illustration



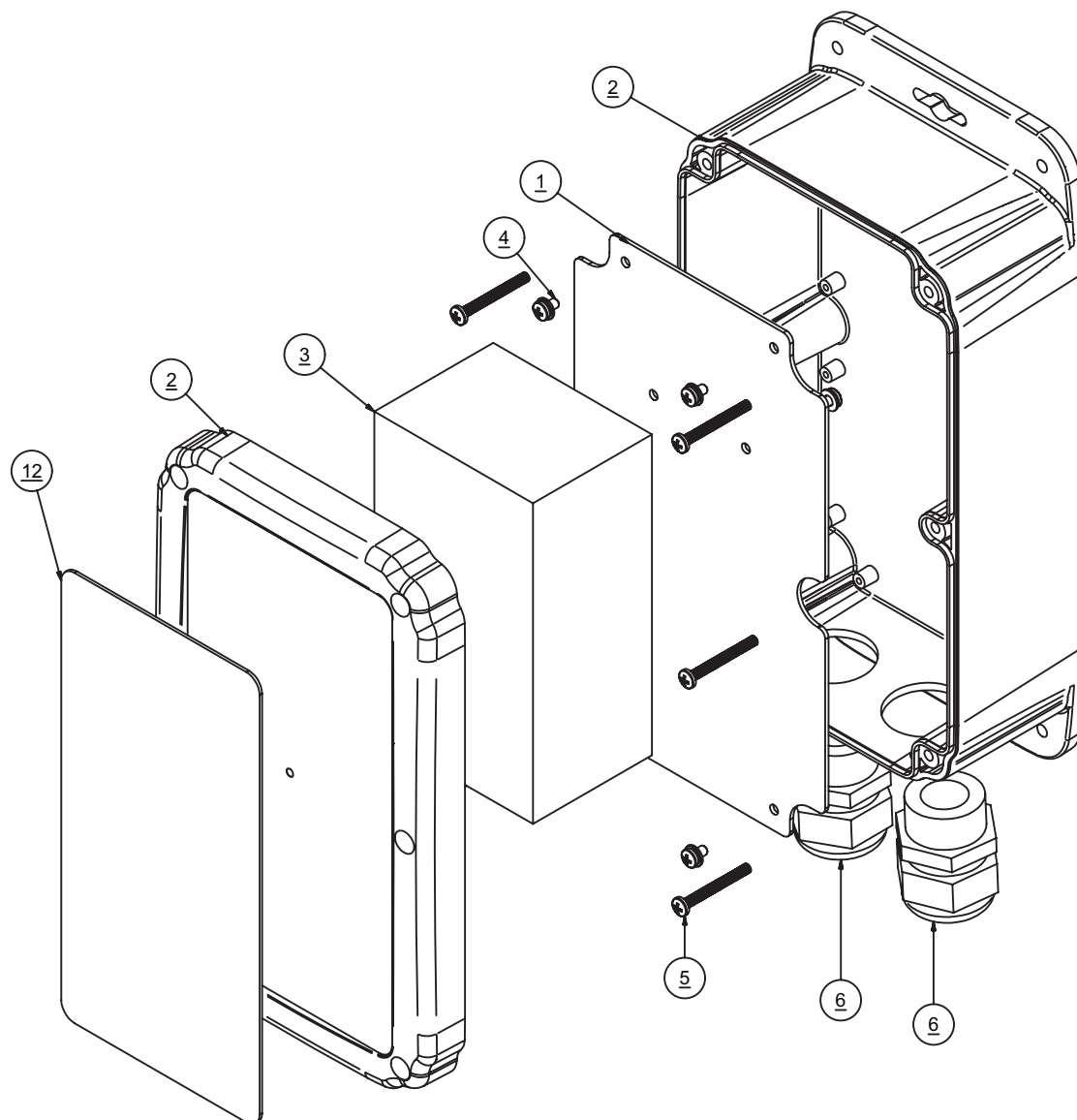
34. UV STERILIZER 12VDC 2GPM B5262000CV

Item No.	Part No.	DESCRIPTION	QTY
1	20010418002A	VALVE BRACKET CLEAN/RINSE KIT	2
2	20010418001A	BRACKET MOUNT SADDLE UV-AW TOP	2
3	40000306CV	UV STERILIZER 2 GPM 12VDC	1
4	40000100CV	UV LAMP 2 GPM	1
5	2614019000	O-RING 212 QUARTZ SLEEVE	1
6	0204091869	CONN 3/8 TUBE X 3/8 MPT PLASTIC	1
7	0204021769	ELB90 3/8 TUBE X 1/4 MPT PLASTIC	1



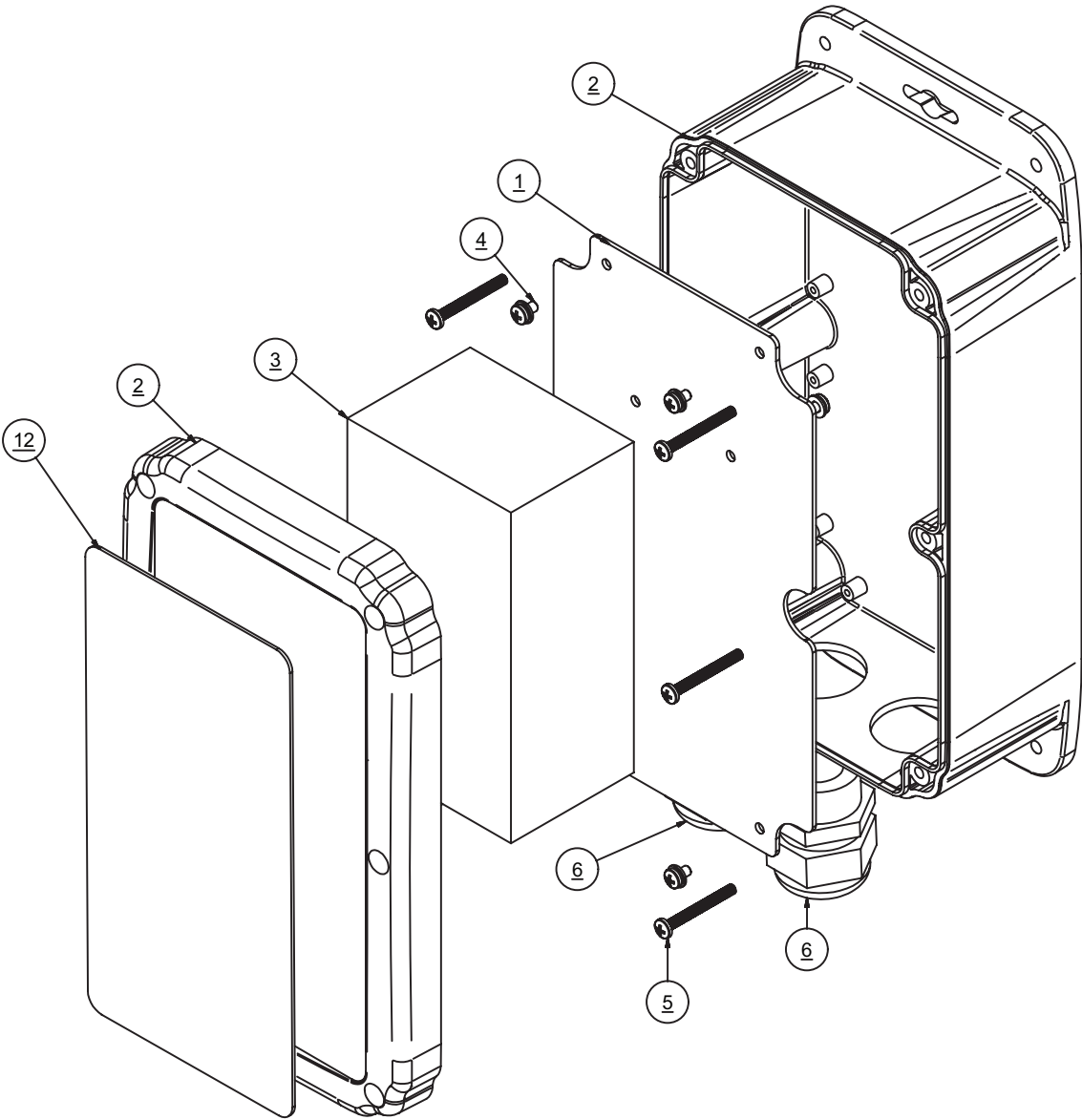
35. SOFTSTART,230V,50-60HZ,SURESTART - EXPLODED B596800014

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	3131232000	CHASSIS PLATE,SOFTSTART,AL	1
2	3120220600	ENCLOSURE,SOFTSTART,POLYCARBON	1
3	3131114002	SOFTSTART, 230V, 1PH, 3HP, SURESTART	1
4	061160620005	SC PHIL PAN #6-32 x 0.25 SPECIAL	6
5	061160620020	SC PHIL PAN 6-32 X 1 1/4 SS	6
6	1904010343	STRAIN RELIEF 3223 .75 GREY	2
7	3131160500	TERMINAL, FEMALE DISCONNECTS,1	1
8	3131164300	WIRE MARKER 1" 12 - 10 AWG	12 FEET
9	3131210495	WIRE NUT YELLOW	1
10	4932231223	WIRE 10/3 SO	6 FEET
11	4932241021	WIRE 14/4 SO BLACK JACKET	6 FEET
12	2213018800	LABEL SOFTSTART 230V SURESTART	1



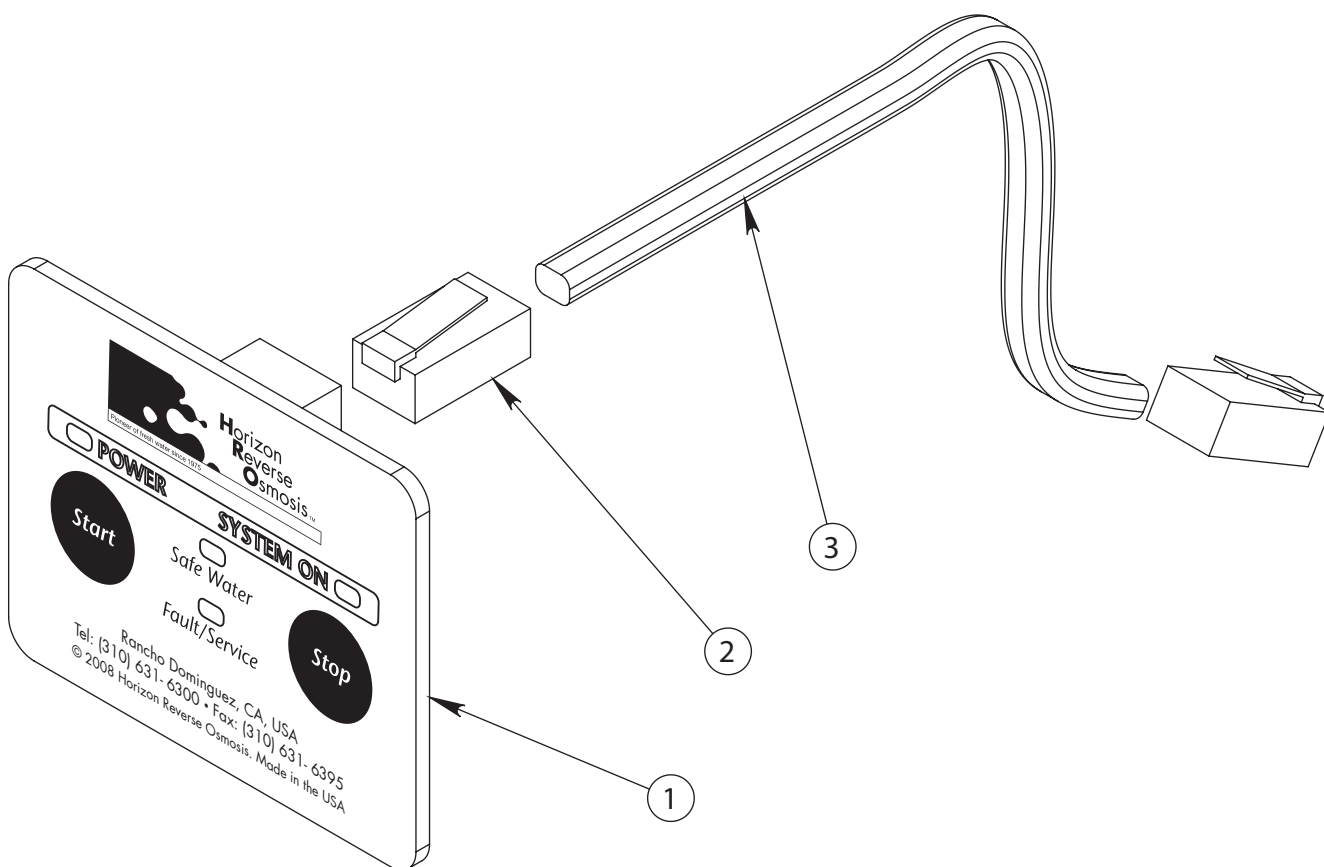
36. SOFTSTART,115V,50-60HZ,SURESTART - EXPLODED B596800015

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	3131232000	CHASSIS PLATE,SOFTSTART,AL	1
2	3120220600	ENCLOSURE,SOFTSTART,POLYCARBON	1
3	3131114001	SOFTSTART, 115V, 1PH, 3HP, SURESTART	1
4	061160620005	SC PHIL PAN #6-32 x 0.25 SPECIAL	6
5	061160620020	SC PHIL PAN 6-32 X 1 1/4 SS	6
6	1904010343	STRAIN RELIEF 3223 .75 GREY	2
7	3131160500	TERMINAL, FEMALE DISCONNECTS,1	1
8	3131164300	WIRE MARKER 1" 12 - 10 AWG	12 FEET
9	3131210495	WIRE NUT YELLOW	1
10	4932231223	WIRE 10/3 SO	6 FEET
11	4932241021	WIRE 14/4 SO BLACK JACKET	6 FEET
12	2213018800	LABEL SOFTSTART 230V SURESTART	1



36. REMOTE ASSY HRO SF/SE/170SF H2606210005

ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1	31315609WE	TOUCH PAD REMOTE HORIZON SEAFA	1	EA
2	3131100900	EZ PLUG RJ45	2	EA
3	4900283104	CABLE MULTIST 8 CON WHT	1	EA



11

ELECTRICAL INFORMATION

Seafari Versatile 450 - 1800

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11 ELECTRICAL INFORMATION

11.1 ELECTRICAL REQUIREMENTS

The Electric Motors within the Horizon Seafari systems start in series with time delay between each motor starting. First, the Booster Pump starts, then the main High Pressure Pump Electric Motor starts.

For a normal Marine Ship installation, the current surges with the Booster Pump starting, then drop down to Booster Pump Electric Motor running Amperes. At the instant of the High Pressure Pump starting, the current surges up again then drop down to normal system running amperage.

Therefore, the Maximum surge current equals the Booster Pump Running Amperage plus the High Pressure Pump Starting Amperage. The normal running Amperage equals both the Booster Pump Motor and High pressure Pump Motor combined running Amperage.

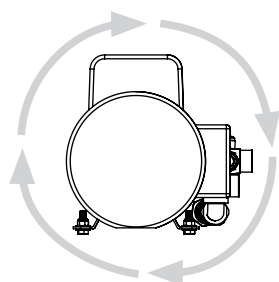
11.1.2 AC INDUCTION MOTORS

After unpacking, check for damage. Be sure that the shaft rotates freely.

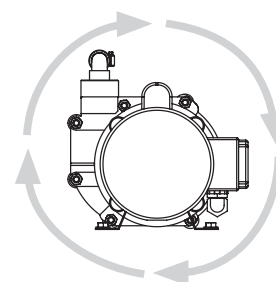
Check line voltage, frequency and phase, ensure that it agrees with system nameplate. Grounding and circuit protection should be done in accordance with National Electrical Code. See connection diagram on nameplate of motor or refer to the diagrams on pages 11-4 through 11-9.

11.1.1 POWER SOURCE REQUIREMENTS

VOLTAGE	HZ (AC)	MIN VOLTAGE	MAX VOLTAGE	MIN HZ	MAX HZ
AC Systems - Single Phase					
120 VAC	60 HZ	108 VAC	132 VAC	58 HZ	62 HZ
230 VAC	60 HZ	207 VAC	253 VAC	58 HZ	62 HZ
220 VAC	50 HZ	198 VAC	242 VAC	48 HZ	52 HZ
AC Systems - Three Phase					
208 VAC	60 HZ	187 VAC	228 VAC	58 HZ	62 HZ
230 VAC	60 HZ	207 VAC	253 VAC	58 HZ	62 HZ
460 VAC	60 HZ	414 VAC	506 VAC	58 HZ	52 HZ
220 VAC	50 HZ	198 VAC	242 VAC	48 HZ	52 HZ
380 VAC	50 HZ	342 VAC	418 VAC	48 HZ	52 HZ



HP Pump Motor
Fan section (back view)



Booster Pump Motor
fan section (back view)

11.1.3 RECOMMENDED CIRCUIT BREAKER

AC VOLTAGE	PHASE	CIRCUIT BREAKER SIZE
115 VAC	Single	30 Amperes
230 VAC	Single	15 Amperes
208 VAC	Three	10 - 15 Amperes
230 VAC	Three	10 Amperes
380 VAC	Three	10 Amperes
460 VAC	Three	5-7.5 Amperes

11.1.4 RECOMMENDED COPPER WIRE & SIZE FOR MAIN POWER FEED LINE

OPERATING VOLTAGE	PHASE	MIN. POWER LINE WIRE SIZE
115 VAC	Single	10 AWG
230 VAC	Single	12 AWG
208 VAC	Three	12 AWG
230 VAC	Three	12 AWG
380 VAC	Three	12 AWG
460 VAC	Three	12 AWG

11.1.5 MOTOR ROTATION

Single Phase Systems:

The High Pressure Pump Electric Motor rotation is pre-wired by HRO prior to shipment.

The Booster Pump Motor rotation is controlled by interchanging two specific wires at the Electric Motors wiring box.

Three Phase Systems

The High Pressure Pump and Booster Pump Electric Motor rotation is controlled by interchanging any two of the three power lines at the Electric Motors wiring box connections.

11.1.6 WIRING CONNECTIONS

Refer to each individual Electrical Motor, which include attached name plate with wiring diagram or separate wiring diagram plate, decal or label.



NOTE: Use the following procedure when changing motor voltage as shown on pages 11-4 through 11-9. Wire nuts are supplied when system is shipped and are taped inside controller lid for voltage modifications.

1. Cut crimped motor leads as close to the crimped terminal.
2. Wires which, need to be jumpered (connected) must be stripped with stripped length not exceeding ½".
3. When two wires are jumpered, use the supplied blue wire nuts. When three wires are jumpered, use the supplied yellow wire nuts.
4. Do not over-tighten wire nuts.

Single-Phase System Rotation:

Jog to check rotation before operating. To reverse rotation interchange motor leads 5 and 8 located inside the rear cover. However, wiring connections listed in this section are proper for the HRO System.

Three-Phase System Rotation:

Jog to check rotation before operating. Three phase motors only - to reverse rotation interchange any two power leads.

11.2 WIRING DIAGRAMS

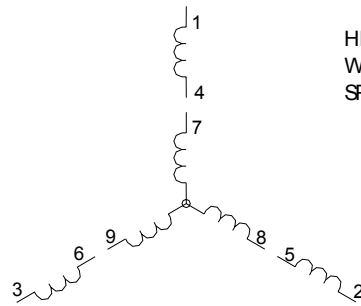
WARNING: ELECTRICAL SHOCK HAZARD. A Volt / Ohm Meter will be necessary. The following installation procedures expose the installer to High Voltage and electrical shock hazard. Only attempt this if you are a qualified electrician and only if surrounding conditions are safe.



NOTE: Refer to Section 13 - Fold Outs (located in the back of this manual) for modular model electrical diagrams.

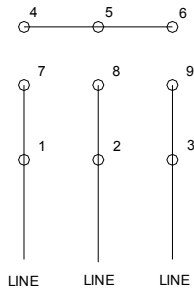
HORIZON Seafari Self-Contained Booster Pump & High Pressure Pump Three Phase, 60 Hz

HIGH PRESSURE PUMP MOTOR
WINDING NUMBER CD0005
SPEC NUMBER JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE
208-230/220/380/460 VAC

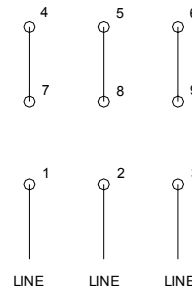


HIGH PRESSURE PUMP MOTOR
WINDING NUMBER CD0005
SPEC NUMBER 35A012Y334G2
3 HORSE POWER
60 Hz, THREE PHASE
208 - 230/460 VAC

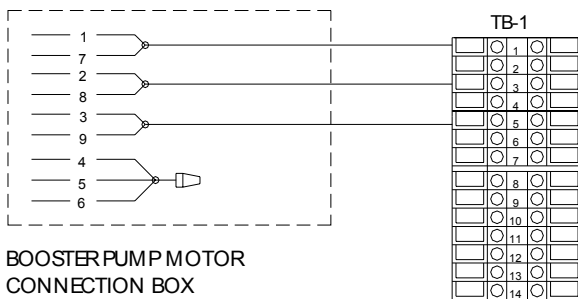
LOW VOLTAGE CONNECTION (2Y)
208 - 230 VAC
THREE PHASE, 60 Hz



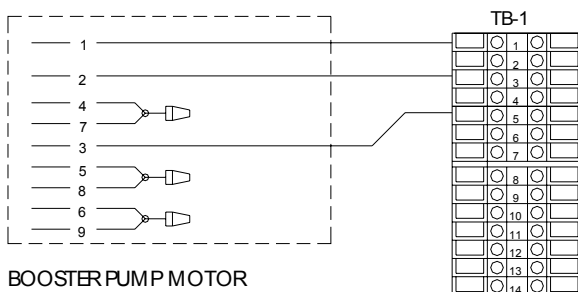
HIGH VOLTAGE CONNECTION (1Y)
460 VAC
THREE PHASE, 60 Hz



BOOSTER PUMP MOTOR WIRING



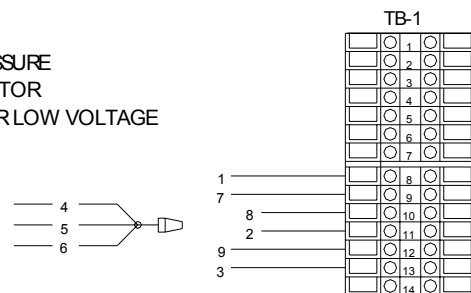
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE



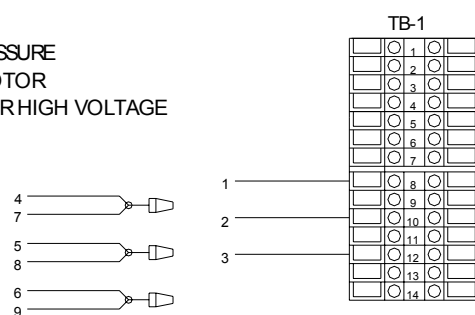
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE

HIGH PRESSURE PUMP MOTOR WIRING

HIGH PRESSURE
PUMP MOTOR
WIRED FOR LOW VOLTAGE



HIGH PRESSURE
PUMP MOTOR
WIRED FOR HIGH VOLTAGE

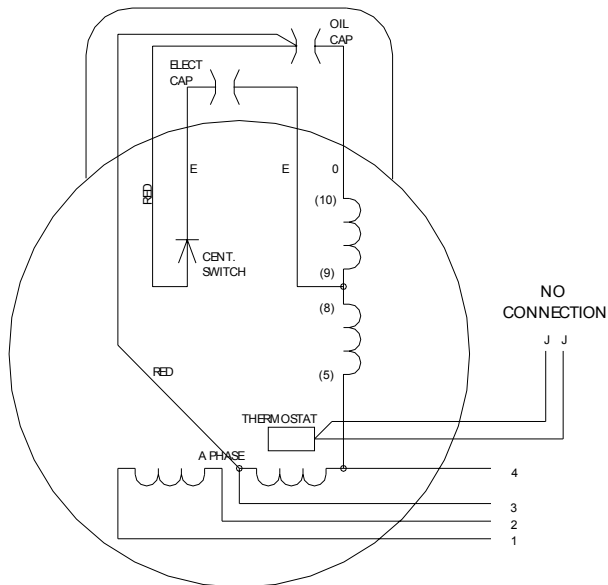


HORIZON Seafari Modular Booster Pump & High Pressure Pump Single Phase 50/60 HZ

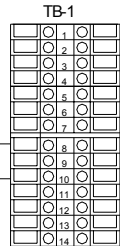
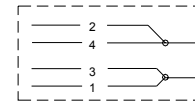
HIGH PRESSURE PUMP MOTOR WIRING

	LINE A	LINE B	JOIN TOGETHER
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/230 VAC	1	4	2, 3

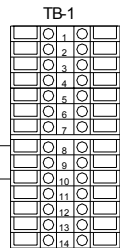
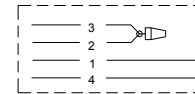
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0615A01
SPEC NUMBER: 35M821T427G1 2.1 HORSE POWER
50/60 Hz SINGLE PHASE
110-115 / 220-230 VAC
AND
SPEC NUMBER: 35M940T426G1 2.5 HORSE POWER
50/60 Hz, SINGLE PHASE
110-115 / 220-230 VAC



MOTOR CONNECTION BOX
HIGH PRESSURE PUMP
LOW VOLTAGE CONNECTION

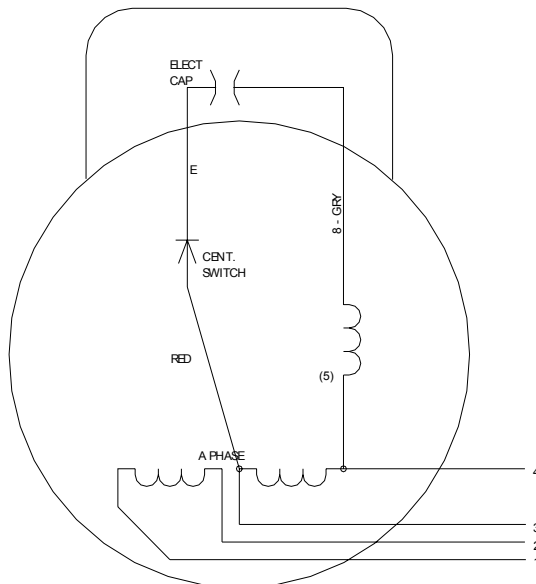


MOTOR CONNECTION BOX
HIGH PRESSURE PUMP
HIGH VOLTAGE CONNECTION

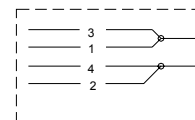


BOOSTER PUMP MOTOR WIRING

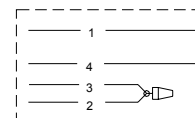
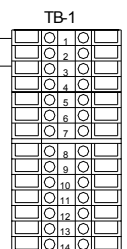
	LINE A	LINE B	JOIN
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/230 VAC	1	4	2, 3



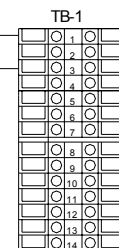
BOOSTER PUMP MOTOR
WINDING NUMBER: CD0093
SPEC NUMBER: 34G757W588 .5 HORSE POWER
50/60 Hz SINGLE PHASE
110-115 / 220-230 VAC



MOTOR CONNECTION BOX
BOOSTER PUMP LOW VOLTAGE
CONNECTION



MOTOR CONNECTION BOX
BOOSTER PUMP HIGH
VOLTAGE
CONNECTION



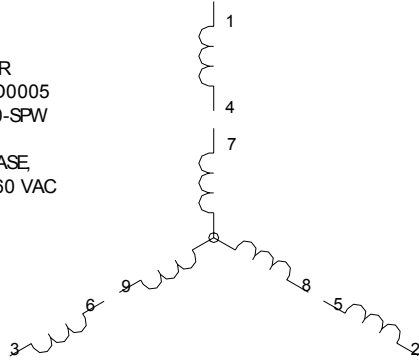
BOOSTER PUMP
LOW VOLTAGE
CONNECTION

BOOSTER PUMP
HIGH VOLTAGE
CONNECTION

HORIZON Seafari Modular Booster Pump and High Pressure Pump Three-Phase, 50 HZ

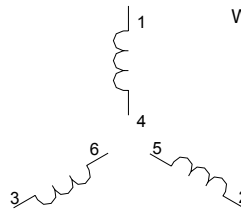
Booster Pump Wiring

BOOSTER PUMP MOTOR
 WINDING NUMBER CD0005
 SPEC NUMBER JM3460-SPW
 .5 HORSE POWER
 50/60 Hz, THREE PHASE
 208-230/220/380/460 VAC

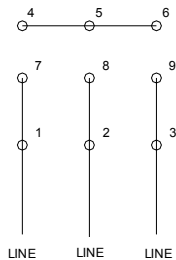


High Pressure Pump Wiring

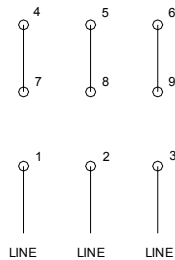
HIGH PRESSURE PUMP MOTOR
 WINDING NUMBER CD0022
 SPECIFICATIONS:
 3 HORSE POWER
 50 Hz, THREE PHASE,
 220/3800 VAC



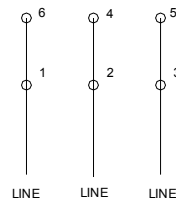
LOW VOLTAGE CONNECTION (2Y) 220 VAC



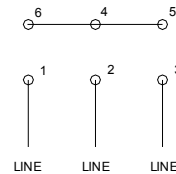
HIGH VOLTAGE CONNECTION (1Y) 380 - 415 VAC



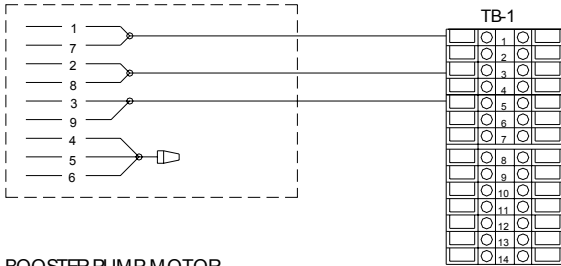
LOW VOLTAGE CONNECTION 220 VAC



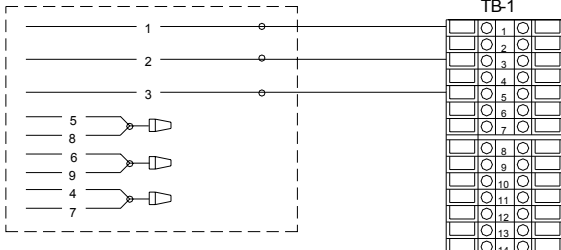
HIGH VOLTAGE CONNECTION 380 - 415 VAC



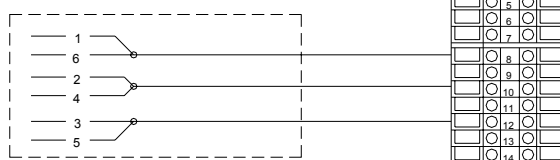
BOOSTER PUMP MOTOR CONNECTION BOX WIRED FOR LOW VOLTAGE



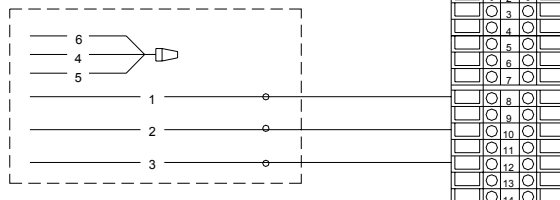
BOOSTER PUMP MOTOR CONNECTION BOX WIRED FOR HIGH VOLTAGE



HIGH PRESSURE PUMP MOTOR CONNECTION BOX WIRED FOR LOW VOLTAGE

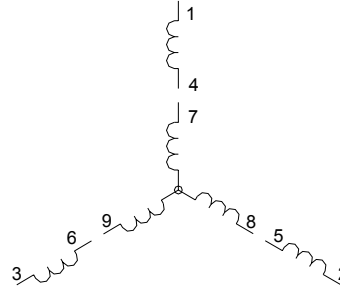


HIGH PRESSURE PUMP MOTOR CONNECTION BOX WIRED FOR HIGH VOLTAGE



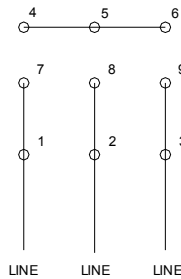
HORIZON Seafari Modular Booster Pump & High Pressure Pump Three Phase, 60 Hz

BOOSTER PUMP MOTOR
WINDING NUMBER CD0005
SPEC NUMBER JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC

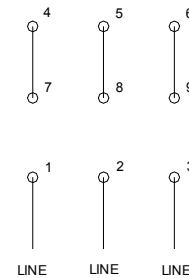


HIGH PRESSURE PUMP MOTOR
WINDING NUMBER CD0005
SPEC NUMBER 35A012Y334G2
3 HORSE POWER
60 Hz, THREE PHASE,
208 - 230/460 VAC

LOW VOLTAGE CONNECTION (2Y)
208 - 230 VAC

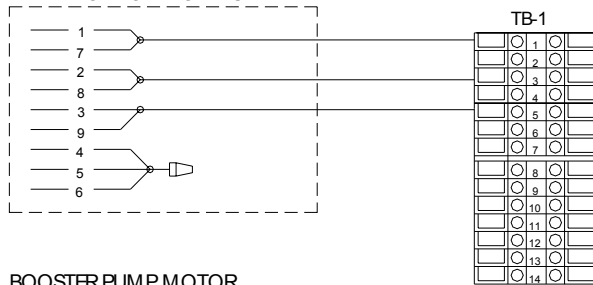


HIGH VOLTAGE CONNECTION (1Y)
460 VAC

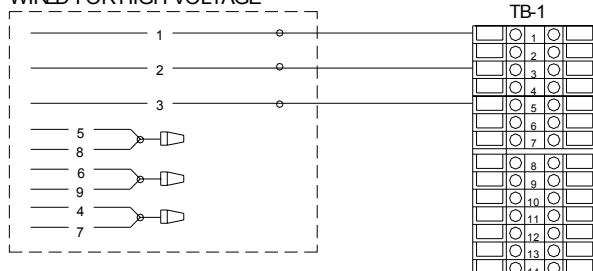


BOOSTER PUMP MOTOR WIRING

BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE

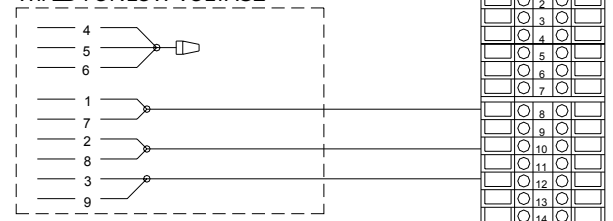


BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE

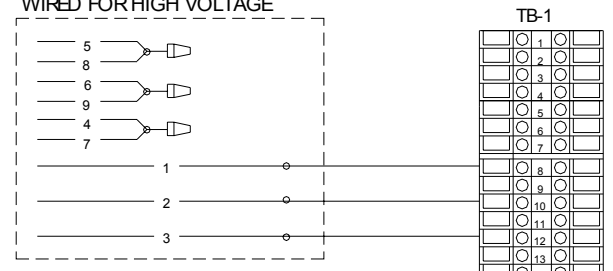


HIGH PRESSURE PUMP MOTOR WIRING

HIGH PRESSURE PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE

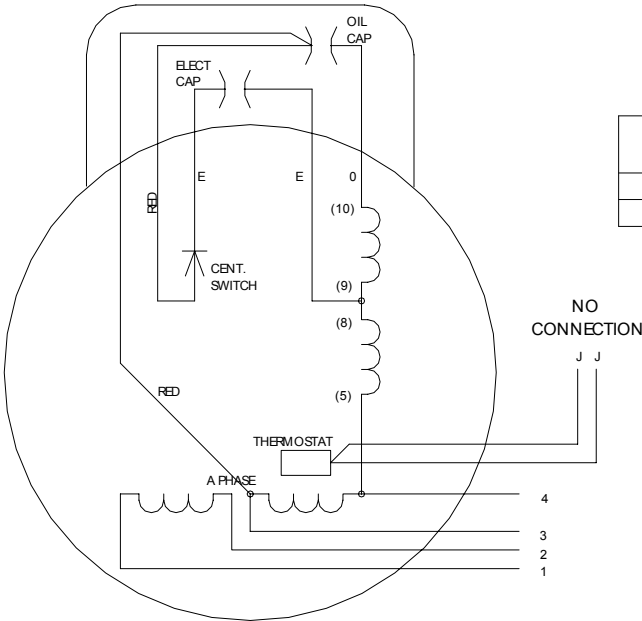


HIGH PRESSURE PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE



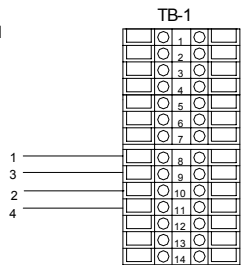
HORIZON Seafari Self-Contained
Booster Pump & High Pressure Pump
Single Phase 50/60 HZ

HIGH PRESSURE PUMP MOTOR WIRING

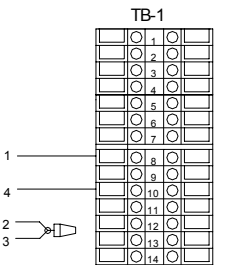


HIGH PRESSURE PUMP MOTOR
WINDING NUMBER CD0615A01
SPEC NUMBER 35M821T427G1 2.1 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC
AND
SPEC NUMBER 35M940T426G1 2.5 HORSE POWER
50/60 Hz, SINGLE PHASE,
110-115 / 220-230 VAC

	LINE A	LINE B	JOIN TOGETHER
LOW VOLTAGE 110/ 120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/ 230 VAC	1	4	2, 3

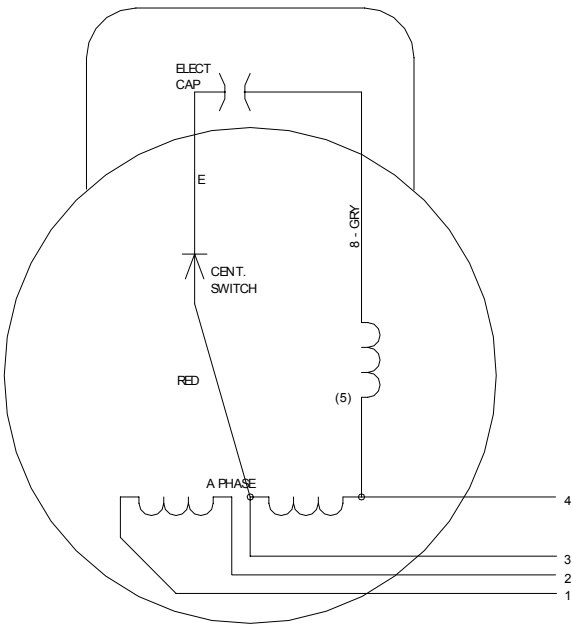


HIGH PRESSURE
PUMP
LOW VOLTAGE
CONNECTION



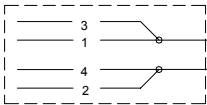
HIGH PRESSURE
PUMP
HIGH VOLTAGE
CONNECTION

BOOSTER PUMP MOTOR WIRING

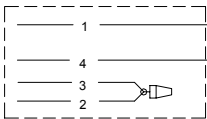


BOOSTER PUMP MOTOR
WINDING NUMBER CD0093
SPEC NUMBER 34G757W588 .5 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC

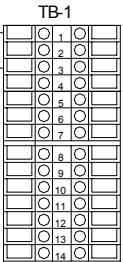
	LINE A	LINE B	JOIN
LOW VOLTAGE 110/ 120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/ 230 VAC	1	4	2, 3



MOTOR CONNECTION BOX
BOOSTER PUMP LOW
VOLTAGE
CONNECTION



MOTOR CONNECTION BOX
BOOSTER PUMP HIGH
VOLTAGE
CONNECTION



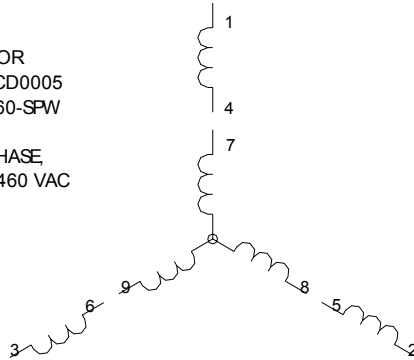
BOOSTER PUMP
LOW VOLTAGE
CONNECTION

BOOSTER PUMP
HIGH VOLTAGE
CONNECTION

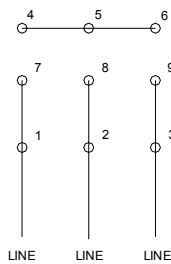
HORIZON Seafari Self-Contained Booster Pump & High Pressure Pump Three-Phase 50 HZ

Booster Pump, Wiring

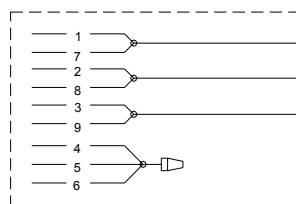
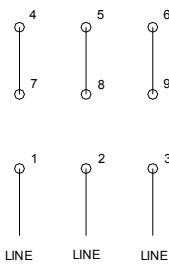
BOOSTER PUMP MOTOR
WINDING NUMBER CD0005
SPEC NUMBER JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC



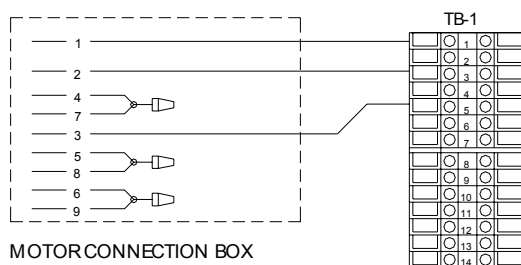
LOW VOLTAGE CONNECTION (2Y) 220 VAC



HIGH VOLTAGE CONNECTION (1Y) 380 - 415 VAC



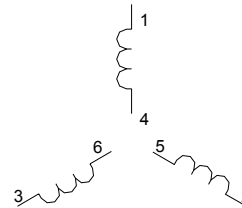
MOTOR CONNECTION BOX
WIRED FOR LOW VOLTAGE



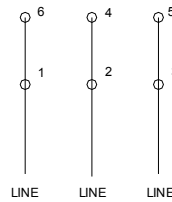
MOTOR CONNECTION BOX
WIRED FOR HIGH VOLTAGE

High Pressure Pump, Wiring

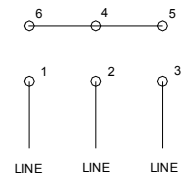
WINDING NUMBER CD0022
SPECIFICATIONS:
3 HORSE POWER
50 Hz, THREE PHASE,
220/380 VAC



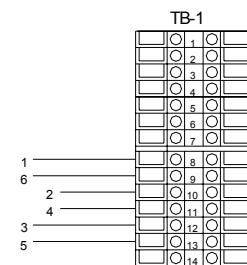
LOW VOLTAGE CONNECTION 220 VAC



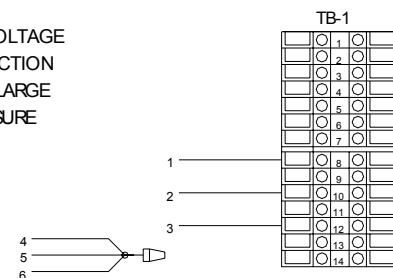
HIGH VOLTAGE CONNECTION 380 - 415 VAC



LOW VOLTAGE CONNECTION INSIDE LARGE ENCLOSURE



HIGH VOLTAGE CONNECTION INSIDE LARGE ENCLOSURE



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12

CONVERSION CHARTS

Seafari Versatile 450 - 1800

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12 CONVERSION CHARTS**12****MICRON / INCH / MESH****COMPARISON MEASUREMENTS**

MICRON	INCH	INCH (opening)	MESH
1	.00003937	.0070	100
5	.00019685	.0075	90
10	.00039370	.0075	80
15	.00059055	.0078	70
20	.00078740	.011	60
25	.00098425	.013	50
30	.00118110	.018	40
40	.00157480	.026	30
50	.00196850	.041	20
75	.00295275	.085	10
100	.0039370	.177	5
200	.0078740	.937	1

TEMPERATURES CELSIUS vs FAHRENHEIT**CONVERSION CHART**

° F	° C	° F	° C
0	-32	122	50
32	0	131	55
41	5	140	60
50	10	149	65
59	15	158	70
68	20	167	75
78	25	176	80
86	30	185	85
95	35	194	90
104	40	203	95
113	45	212	100

$$^{\circ}\text{CELSIUS} = 0.556 (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{FAHRENHEIT} = (1.8^{\circ}\text{C}) + 32$$

12.3 TEMPERATURE EFFECT COMPARISON CHART

(At 850 psi & 35,000 ppm feedwater TDS conditions)

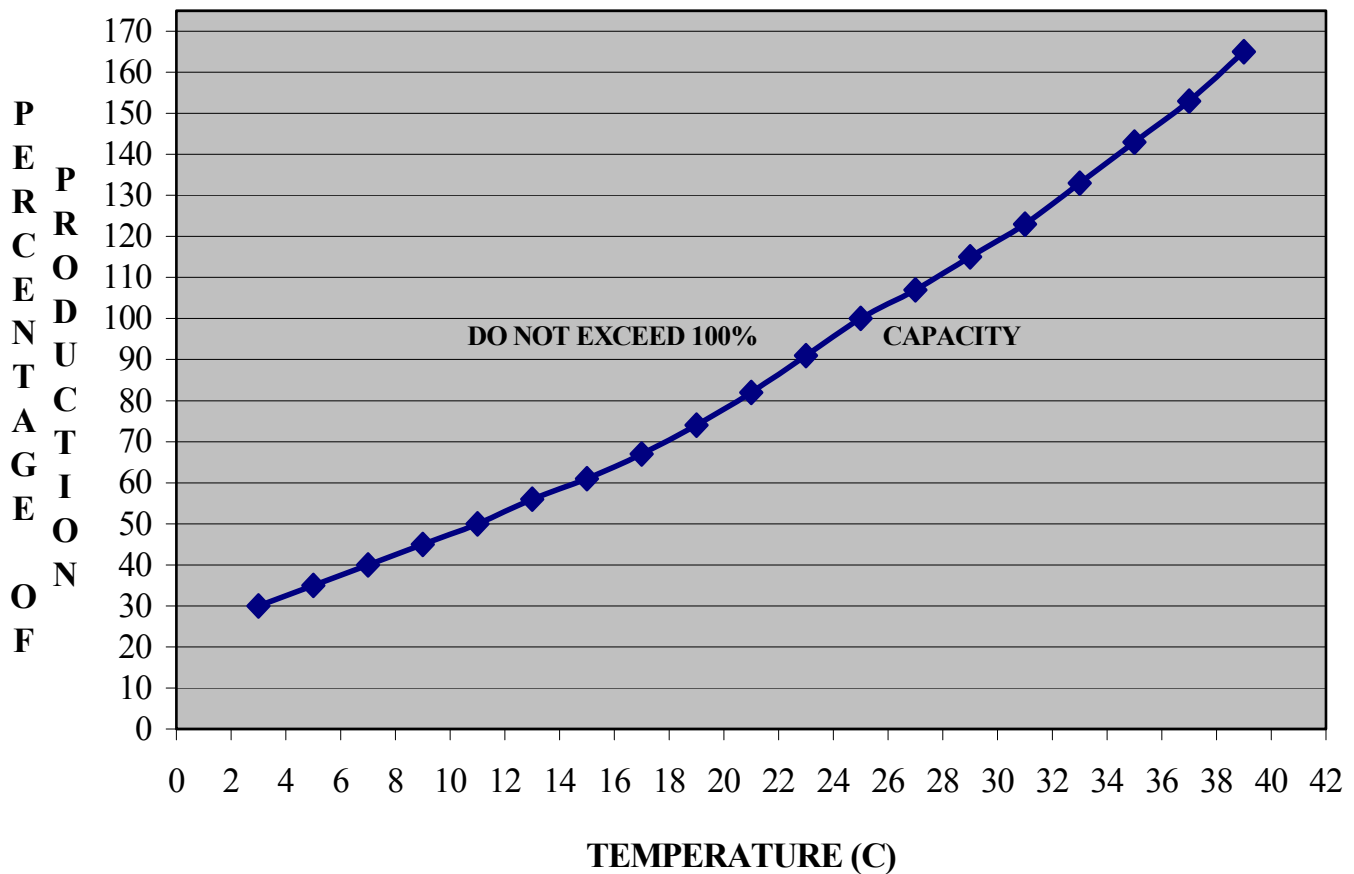
The Temperature Effect Chart on this page illustrates the loss or gain of productivity across the R.O. Membrane.

To determine what normal (in spec.) flow of the system is at 77° F / 25° C, follow these directions:

1. Determine feed source temperature.
2. Locate the corresponding temperature on the chart.
3. Follow the corresponding temperature in a vertical line up to the plotted production line.
4. From this temperature point at the production line, move left horizontally to the plotted productivity percent.
5. Calculate the system's present productivity in U.S. gallons per day by multiplying the gallon per hour product water flowmeter reading by 24.
6. Divide the figure reached in step 5 above, present gallon per day productivity, by the plotted productivity percentage from step 4 above. The answer will be equivalent to the membranes present productivity at specification test parameters, 850 psi & 77° F / 25° C.

Example:

1. The system is operating at 850 psi & producing product water
2. The present feed temperature is 61° F / 16° C.
3. Plotted productivity is therefore 72% of normal.
4. The system is a 420 gallon per day model and it is presently producing 290 gallons per day.
5. 290 gallons per day divided by .72 equals 402 gallons per day calculated productivity. The system is rated at 420 gallons per day $\pm$ 15% (357 to 483 gallons per day). Therefore the system is within specifications at 290 gallons per day actual productivity at 61° F / 16° C, 850 psi, and 35,000 ppm feed.



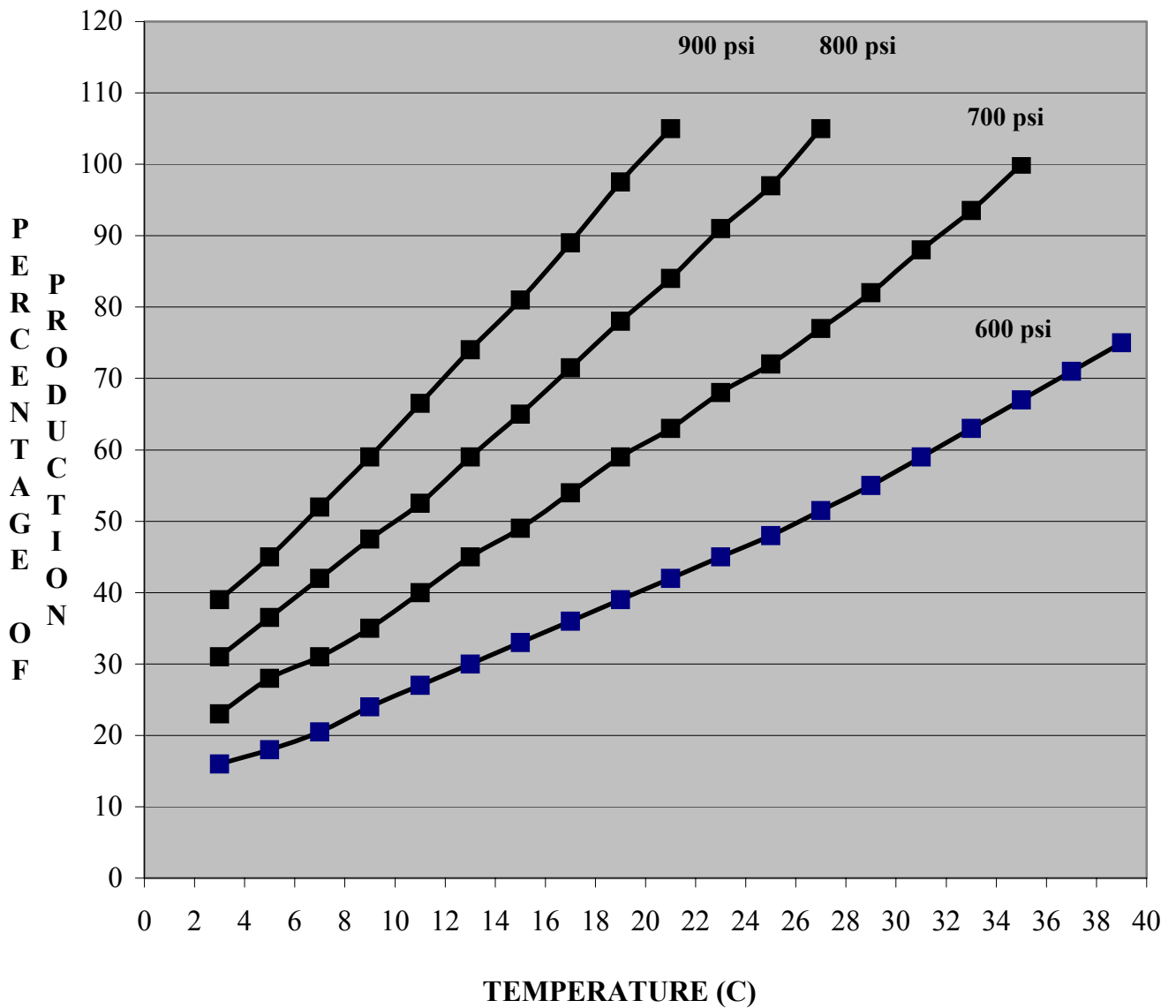
12.4 SEA WATER TEMPERATURE & PRESSURE EFFECTS CHART

(Do not use this chart for Brackish water systems & applications)

As the seawater temperature increases, the Horizon Seafari system pressure must be adjusted so that the system achieves no greater than 100% of rated product water flow. Product water flow greater than 100% of rated capacity causes premature fouling of the HRO R.O. Membrane Elements. This will lead to more frequent required cleaning and voids all warranties of the HRO R.O. membrane elements.

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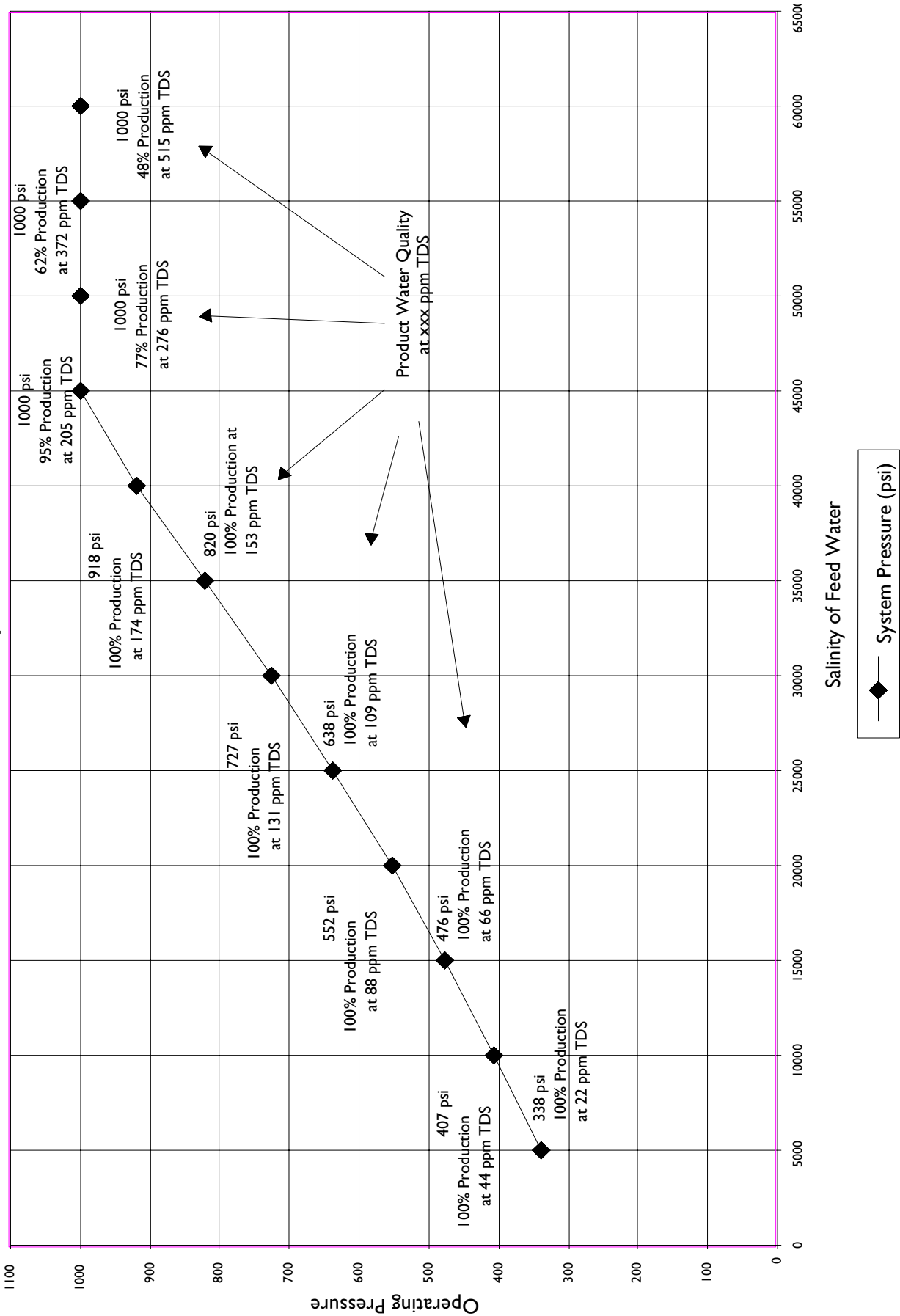
DO NOT EXCEED 100% OF RATED PRODUCTION!!!



12.5 SALINITY EFFECTS CHART

12

Salinity Effects Chart



12.6 WATER COMPARISON CHART

12

GALLONS / VOLUME / WEIGHT

U.S. GALLON	CUBIC FEET	CUBIC YARD	CUBIC METER	TON SHORT	TON METRIC
1	.13	.005	.004	.004	.004
5	.67	.025	.019	.021	.019
10	1.34	.050	.038	.041	.038
25	3.34	.129	.10	.104	.094
50	6.68	.248	.19	.208	.189
100	13.37	.50	.38	.42	.38
200	26.74	.99	.76	.83	.76
300	40.10	1.49	1.14	1.25	1.13
400	53.47	1.98	1.51	1.67	1.51
500	66.84	2.48	1.89	2.08	1.89
600	80.21	2.97	2.27	2.50	2.27
700	93.58	3.47	2.65	2.92	2.65
800	06.94	3.96	3.03	3.33	3.02
900	120.31	4.46	3.41	3.75	3.40
1,000	133.68	4.95	3.79	4.17	3.78
2,500	334.20	12.38	9.46	10.41	9.45
5,000	668.40	24.76	18.93	20.83	18.89
7,500	1002.60	37.13	28.39	31.24	28.34
10,000	1336.81	49.51	37.85	41.65	37.79
25,000	3342.00	123.80	94.60	104.10	94.50
50,000	6684.00	247.60	189.30	208.30	188.90
75,000	100.6.00	371.30	283.90	312.40	283.40
100,000	13368.06	495.11	378.54	416.50	377.85

1 U.S. GALLON	=	231. CU. INCH
1 U.S. GALLON OF WATER	=	8.33 LBS.
1 SHORT TON	=	2000 LBS.
1 METRIC TON	=	2204.6 LBS.
1 CU. INCH OF WATER	=	0.0360 LBS.
1 CU. FOOT OF WATER	=	62.4 LBS.
1 IMPERIAL GALLON OF WATER	=	10.0 LBS.
1 GALLON	=	3.7854 LITERS
1 CUBIC METER	=	1000 LITERS
1 CUBIC METER	=	264 GALLONS

12.7 PPM CONVERSION CHART

12

SPECIFIC CONDUCTANCE IN MICROMHOS	SPECIFIC RESISTANCE IN OHMS	DISSOLVED SOLIDS		RESISTANCE*	
		P.P.M.	MHOS	OHMS	P.P.M.
.0385	26,000,000	NONE	250.0	4,000	125
.0556	18,000,000	.02777	256.4	3,900	128
.0625	16,000,000	.03125	263.2	3,800	132
.0714	14,000,000	.03571	270.3	3,700	135
.0833	12,000,000	.04166	277.8	3,600	139
.1	10,000,000	.05	285.7	3,500	143
.125	8,000,000	.0625	294.1	3,400	147
.167	6,000,000	.08333	303.0	3,300	152
.2	5,000,000	.1	312.0	3,200	156
.25	4,000,000	.125	322.5	3,100	161
.5	2,000,000	.25	333.3	3,000	166
1	1,000,000	.5	344.8	2,900	172
2	500,000	1	357.0	2,800	179
4	250,000	2	370.4	2,700	185
6	166,666	3	384.6	2,600	192
8	125,000	4	400.0	2,500	200
10	100,000	5	416.6	2,400	208
12	83,333	6	434.8	2,300	217
14	71,428	7	454.5	2,200	227
16	62,500	8	476.2	2,100	238
18	55,555	9	500.0	2,000	250
20	50,000	10	526.3	1,900	263
22	45,454	11	555.5	1,800	278
24	41,666	12	588.2	1,700	294
26	38,461	13	625.0	1,600	312
28	35,714	14	666.6	1,500	333
30	33,333	15	714.2	1,400	357
40	25,000	20	769.2	1,300	384
50	20,000	25	833.3	1,200	416
60	16,666	30	909.0	1,000	500
70	14,286	35	1,000	1,000	500
80	12,500	40	1,111	900	555
100	10,000	50	1,250	800	625
120	8,333	60	1,428	700	714
140	7,142	70	1,666	600	833
160	6,250	80	2,000	500	1,000
180	5,555	90	2,500	400	1,250
200	5,000	100	3,333	300	1,667
			5,000	200	2,500
			10,000	100	5,000

*Approximate dissolved solids expressed as Calcium Carbonate (CaCO₃)

12.8 PRESSURE

psi	Kg/cm ²	"Hg	bar	kPa	atmosphere
1	0.0704	2.036	0.0689	6.895	0.0681
14.22	1	28.96	0.981	98.07	0.968
0.4912	0.0345	1	0.0339	3.386	0.03342
14.504	1.02	29.53	1	100	0.987
0.14504	0.0102	0.295	0.01	1	0.00987
14.7	1.033	29.92	1.013	101.3	1

PRESSURE

psi	Kg/cm ²	"Hg	bar	kPa	atmosphere
1 psi	= 0.0704 Kg/cm ²	= 2.036 Hg	= 0.0689 bar	= 6.895 kPa	= 0.0681 atm
14.22	= 1	= 28.96	= 0.981	98.07	= 0.968
0.4912	= 0.0345	= 1	= 0.0339	= 3.386	= 0.03342
14.504	= 1.02	= 29.53	= 1	= 100	= 0.987
0.14504	= 0.0102	= 0.295	= 0.01	= 1	= 0.00987
14.7	= 1.033	= 29.92	= 1.013	= 101.3	= 1

METRIC / U.S. CUSTOMARY UNIT EQUIVALENTS

multiply:	by:	to get or multiply:	by:	to get:
LINEAR				
inch	x 25.4	= millimeters (mm)	x 0.03937	= inch
feet	x 0.3048	= meters (m)	x 3.281	= feet
yard	x 0.9144	= meters (m)	x 1.0936	= yard
mile	x 1.6093	= kilometers (km)	x 0.6214	= mile
inch	x 2.54	= centimeters (cm)	x 0.3937	= inch
VOLUME				
fluid oz	x 29.57	= milliliters (ml)	x 0.03381	= fluid oz
U.S. quart	x 0.94635	= liters(l)	x 1.0567	= quarts
U.S. gallon	x 3.7854	= liters(l)	x 0.2642	= gallons
feet ³	x 28.317	= liters	x 0.03531	= feet ³
feet ³	x 0.02832	= meters ³	x 35.315	= feet ³
yard ³	x 0.7646	= meters ³	x 1.3080	= yard ³
MASS				
ounces	x 28.35	= grams(g)	x 0.03527	= ounces
pounds	x 0.4536	= kilograms (kg)	x 2.2046	= pounds
tons (2000lb)	x 907.18	= kilograms (kg)	x 0.001102	= tons
tons (2000lb)	x 0.90718	= metric tons(t)	x 1.1023	= tons

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Chapter 13

Certifications



Confirmation of Product Type Approval 04/AUG/2011

Please refer to the "Service Restrictions" shown below to determine if Unit Certification is required for this product.

This is to certify that, pursuant to the Rules of the American Bureau of Shipping (ABS), the manufacturer of the below listed product held a valid Manufacturing Assessment (MA) with expiration date of 19/MAY/2014. The continued validity of the Manufacturing Assessment is dependent on completion of satisfactory audits as required by the ABS Rules.

And; a Product Design Assessment (PDA) valid until 22/NOV/2015 subject to continued compliance with the Rules or standards used in the evaluation of the product.

The above entitle the product to be called Product Type Approved.

The Product Design Assessment is valid for products intended for use on ABS classed vessels, MODUs or facilities which are in existence or under contract for construction on the date of the ABS Rules used to evaluate the Product.

ABS makes no representations regarding Type Approval of the Product for use on vessels, MODUs or facilities built after the date of the ABS Rules used for this evaluation.

Due to wide variety of specifications used in the products ABS has evaluated for Type Approval, it is part of our contract that; whether the standard is an ABS Rule or a non-ABS Rule, the Client has full responsibility for continued compliance with the standard.

SEA RECOVERY CORP. Model Name(s): Seafari Versatile

Presented to:

SEA RECOVERY CORP.
19610 S. RANCHO WAY
RANCHO DOMINGUEZ
United States

Intended Service:	Marine & Offshore Application - Production of Fresh Water by Sea Desalination
Description:	Reverse Osmosis Desalination Unit. See attached "pdf" product details
Ratings:	Seafari Versatile 450-1: 18 GPH Seafari Versatile 700-1: 26 GPH Seafari Versatile 900-1: 38 GPH Seafari Versatile 900-2: 38 GPH Seafari Versatile 1400-2: 58 GPH Seafari Versatile 1800-2: 75 GPH
Service Restrictions:	Unit Certification is not required for this product. If the manufacturer or purchaser request an ABS Certificate for compliance with a specification or standard, the specification or standard, including inspection standards and tolerances, must be clearly defined.
Comments:	1) The use of PVC piping is limited to 35 psi for water application.
Notes / Documentation:	Supporting Document: Dwg No. 900-2, Rev.- Seafari Versatile Modular
Term of Validity:	This Product Design Assessment (PDA) Certificate 06-HS159834B-2-PDA, dated 03/Aug/2011 remains valid until 22/Nov/2015 or until the Rules or specifications used in the assessment are revised (whichever occurs first). This PDA is intended for a product to be installed on an ABS classed vessel, MODU or facility which is in existence or under contract for construction on the date of the ABS Rules or specifications used to evaluate the Product. Use of the Product on an ABS classed vessel, MODU or facility which is contracted after the validity date of the ABS Rules and specifications used to evaluate the Product, will require re-evaluation of the PDA. Use of the Product for non ABS classed vessels, MODUs or facilities is to be to an agreement between the manufacturer and intended client.

ABS Rules: 2010 Steel Vessels Rules 1-1-4/7.7, 1-1-Appendix 3, 4-6-2/5.7

National Standards:

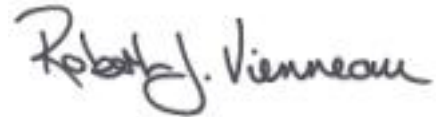
International Standards:

Government Authority:

EUMED:

Others: None.

Model Certificate	Model Certificate No	Issue Date	Expiry Date
PDA	06-HS159834B-2-PDA	03/AUG/2011	22/NOV/2015



ABS Programs

ABS has used due diligence in the preparation of this certificate and it represents the information on the product in the ABS Records as of the date and time the certificate was printed. Type Approval requires Drawing Assessment, Prototype Testing and assessment of the manufacturer's quality assurance and quality control arrangements. Limited circumstances may allow only Prototype Testing to satisfy Type Approval. The approvals of Drawings and Products remain valid as long as the ABS Rule, to which they were assessed, remains valid. ABS cautions manufacturers to review and maintain compliance with all other specifications to which the product may have been assessed. Further, unless it is specifically indicated in the description of the product; Type Approval does not necessarily waive witnessed inspection or survey procedures (where otherwise required) for products to be used in a vessel, MODU or facility intended to be ABS classed or that is presently in class with ABS. Questions regarding the validity of ABS Rules or the need for supplemental testing or inspection of such products should, in all cases, be addressed to ABS.



CERTIFICATE NUMBER

06-HS159834B-2-PDA

DATE

03 August 2011

ABS TECHNICAL OFFICE

Houston SED - Ship Equipment

CERTIFICATE OF DESIGN ASSESSMENT

This is to Certify that a representative of this Bureau did, at the request of
SEA RECOVERY CORP. - RANCHO DOMINGUEZ

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate.

PRODUCT: **Desalinator, Reverse Osmosis**

MODEL: **Seafari Versatile**

This Product Design Assessment (PDA) Certificate 06-HS159834B-2-PDA, dated 03/Aug/2011 remains valid until 22/Nov/2015 or until the Rules or specifications used in the assessment are revised (whichever occurs first).

This PDA is intended for a product to be installed on an ABS classed vessel, MODU or facility which is in existence or under contract for construction on the date of the ABS Rules or specifications used to evaluate the Product.

Use of the Product on an ABS classed vessel, MODU or facility which is contracted after the validity date of the ABS Rules and specifications used to evaluate the Product, will require re-evaluation of the PDA.

Use of the Product for non ABS classed vessels, MODUs or facilities is to be to an agreement between the manufacturer and intended client.

AMERICAN BUREAU OF SHIPPING

Marcelo Contrucci (Marcelo Mattos) De Mattos

Engineer

NOTE: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of ABS or a statutory, industrial or manufacturer's standards. It is issued solely for the use of ABS, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without approval from ABS will result in this certificate becoming null and void. This certificate is governed by the terms and conditions as contained in ABS Rules 1-1-A3/5.9 Terms and Conditions of the Request for Product Type Approval and Agreement (2010).

SEA RECOVERY CORP.

19610 S. RANCHO WAY
RANCHO DOMINGUEZ
CA 90220
United States
Telephone: 310-637-3400
Fax: 310-637-3430
Email: lisa@searecovery.com
Web: www.searecovery.com

MA Certificate No. 09-LA1657385-X

Product: Desalinator, Reverse Osmosis

Model: Seafari Versatile

Intended Service:

Marine & Offshore Application - Production of Fresh Water by Sea Desalination

Description:

Reverse Osmosis Desalination Unit. See attached "pdf" product details

Ratings:

Seafari Versatile 450-1: 18 GPH
Seafari Versatile 700-1: 26 GPH
Seafari Versatile 900-1: 38 GPH
Seafari Versatile 900-2: 38 GPH
Seafari Versatile 1400-2: 58 GPH
Seafari Versatile 1800-2: 75 GPH

Service Restrictions:

Unit Certification is not required for this product. If the manufacturer or purchaser request an ABS Certificate for compliance with a specification or standard, the specification or standard, including inspection standards and tolerances, must be clearly defined.

Comments:

1) The use of PVC piping is limited to 35 psi for water application.

Notes / Drawings / Documentation:

Supporting Document:

Dwg No. 900-2, Rev.- Seafari Versatile Modular

Term of Validity:

This Product Design Assessment (PDA) Certificate 06-HS159834B-2-PDA, dated 03/Aug/2011 remains valid until 22/Nov/2015 or until the Rules or specifications used in the assessment are revised (whichever occurs first).

This PDA is intended for a product to be installed on an ABS classed vessel, MODU or facility which is in existence or under contract for construction on the date of the ABS Rules or specifications used to evaluate the Product.

Use of the Product on an ABS classed vessel, MODU or facility which is contracted after the validity date of the ABS Rules and specifications used to evaluate the Product, will require re-evaluation of the PDA.

Use of the Product for non ABS classed vessels, MODUs or facilities is to be to an agreement between the manufacturer and intended client.

STANDARDS**ABS Rules:**

2010 Steel Vessels Rules 1-1-4/7.7, 1-1-Appendix 3, 4-6-2/5.7

National:

NA

SEA RECOVERY CORP.

19610 S. RANCHO WAY
RANCHO DOMINGUEZ

CA 90220

United States

Telephone: 310-637-3400

Fax: 310-637-3430

Email: lisa@searecovery.com

Web: www.searecovery.com

MA Certificate No. 09-LA1657385-X

International:

NA

Government Authority:

NA

EUMED:

NA

Others:

None.

Declaration of Conformity

CE

HORIZON REVERSE OSMOSIS declares that the following models conform to the EN 55011A and EN 50082-2 standards:

Product Series:

Horizon Seafari Versatile Series
Horizon Seafari Mini Series
Horizon Seafari Escape Series

Model Names:

Seafari Versatile
Seafari Mini
Seafari Escape



Manufacturer's Name:
Horizon Reverse Osmosis
Manufacturer's Address:
19610 South Rancho Way
Rancho Dominguez, CA 90220
U.S.A.



Official Seal

Supplementary Information:

"The product complies with the Requirements of the EMC Directive 89/336/EEC."

Lisa Gomez
Quality & Environmental Manager
Manufacturer's Contact

ABS Quality Evaluations

Certificate Of Conformance

This is to certify that the Environment Management System of:

Danfoss Sea Recovery Corp./Horizon Reverse Osmosis

19610 South Rancho Way
Rancho Dominguez, CA 90220
U.S.A

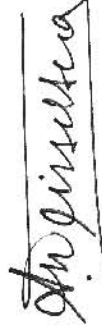
has been assessed by ABS Quality Evaluations, Inc. and found to be in conformance with the requirements set forth by:

ISO 14001:2004

The Environment Management System is applicable to:

DESIGN AND MANUFACTURE OF REVERSE OSMOSIS DESALINATORS FOR THE MARINE INDUSTRY

Certificate No: 46063
Effective Date: 18 January 2012
Expiration Date: 17 January 2015
Issue Date: 18 January 2012



Alex Weisselberg, President



Validity of this certificate is based on the periodic audits of the management system defined by the above scope and is contingent upon prompt, written notification to ABS Quality Evaluations, Inc. of significant changes to the management system or components thereof.

ABS Quality Evaluations, Inc. 16855 Northchase Drive, Houston, TX 77060, U.S.A.

Validity of this certificate may be confirmed at www.abs-qe.com/cert_validation.

ABS Quality Evaluations

Certificate Of Conformance

This is to certify that the Quality Management System of:

Danfoss Sea Recovery Corp./Horizon Reverse Osmosis

**19610 South Rancho Way
Rancho Dominguez, CA 90220
U.S.A**

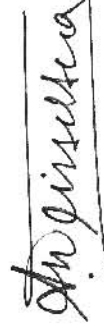
has been assessed by ABS Quality Evaluations, Inc. and found to be in conformance with the requirements set forth by:

ISO 9001:2008

The Quality Management System is applicable to:

DESIGN AND MANUFACTURE OF REVERSE OSMOSIS DESALINATORS

Certificate No: 45511
Effective Date: 28 December 2010
Expiration Date: 27 December 2013
Issue Date: 02 February 2011



Alex Weisselberg, President



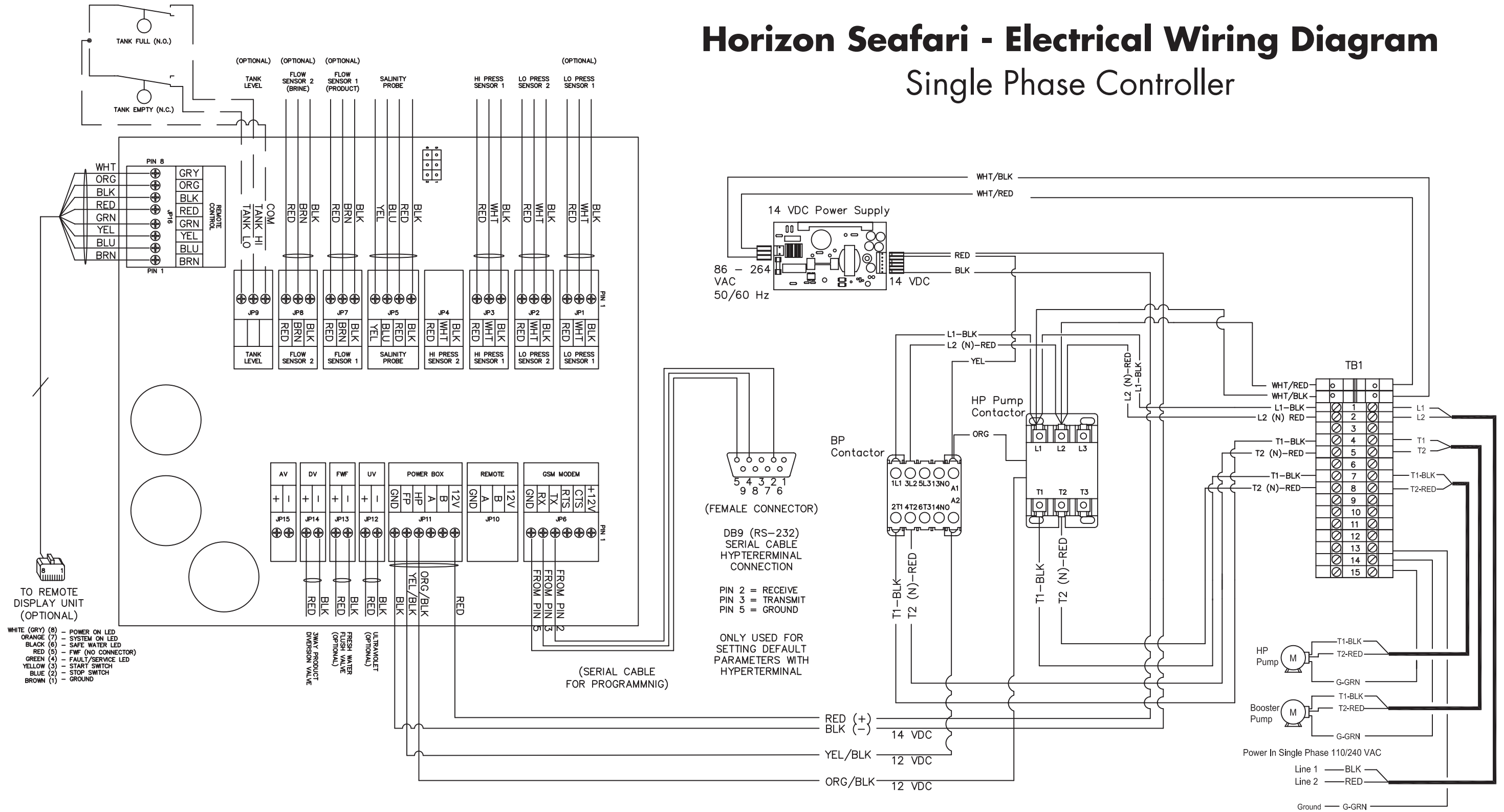
Validity of this certificate is based on the periodic audits of the management system defined by the above scope and is contingent upon prompt, written notification to ABS Quality Evaluations, Inc. of significant changes to the management system or components thereof.

ABS Quality Evaluations, Inc. 16855 Northchase Drive, Houston, TX 77060, U.S.A.

Validity of this certificate may be confirmed at www.abs-qe.com/cert_validation.

Horizon Seafari - Electrical Wiring Diagram

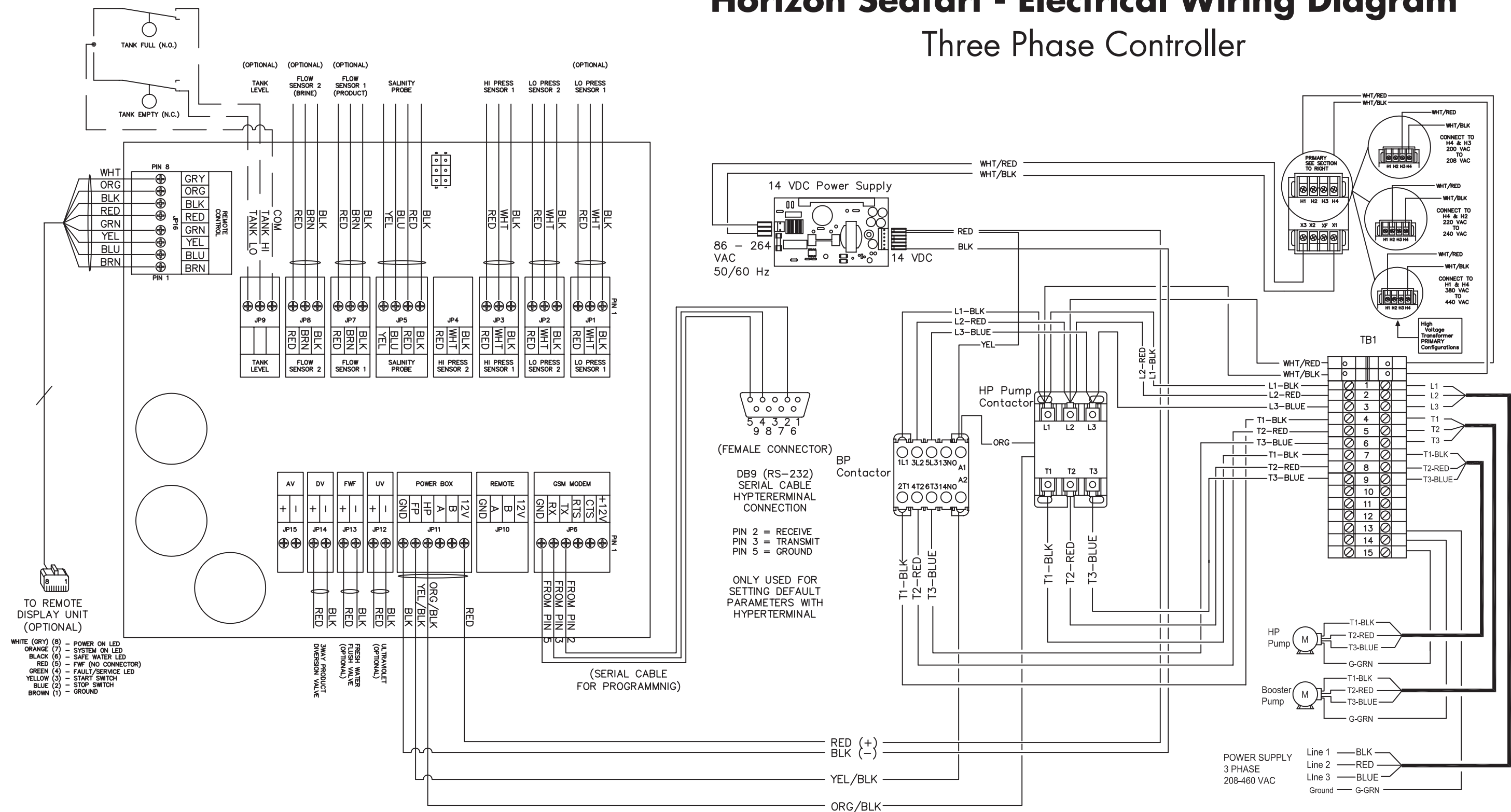
Single Phase Controller



WARNING:
BOOSTER PUMP ELECTRIC MOTOR
AND HIGH PRESSURE PUMP ELECTRIC MOTOR
MUST BE WIRED AT THE MOTOR FOR THE
CORRESPONDING SUPPLY POWER

Horizon Seafari - Electrical Wiring Diagram

Three Phase Controller



WARNING:
BOOSTER PUMP ELECTRIC MOTOR
AND HIGH PRESSURE PUMP ELECTRIC MOTOR
MUST BE WIRED AT THE MOTOR FOR THE
CORRESPONDING SUPPLY POWER



Horizon Reverse Osmosis

2630 E. El Presidio Street

Carson, CA 90810

sales@hrosystems.com

www.hrosystems.com